

APPENDIX B

STOCK ASSESSMENT AND FISHERY EVALUATION REPORT

FOR THE GROUND FISH RESOURCES OF THE GULF OF ALASKA

Compiled by

The Plan Team for the Groundfish Fisheries of the Gulf of Alaska



with contributions by

T. A'mar, S. Barbeaux, J. Boldt, E. Brown, C. Brylinsky, D. Carlile, D. Chen, B. Clark, D. Clausen, D. Courtney, M. Dorn, E. Eisenhardt, L. Fritz, J. Fujioka, S. Gaichas, K. Goldman, M.A. Guttormsen, D. Hanselman, S.R. Hare, J. Heifetz, A. Hollowed, J. Ianelli, R. Lauth, S. Lowe, C. Lunsford, B. Megrey, V. O'Connell, T. Pearson, N. Sagalkin, K. Shotwell, M. Sigler, B. Sinclair, K. Spalinger, D. Stevenson, W. Stockhausen, D. Stram, R. Swanson, G. Thompson, C. Tribuzio, T. Tsou, B. Turnock, T. Wilderbuer, M. Wilkins, C. Wilson, and H. Zenger.

November 2005

**North Pacific Fishery Management Council
605 W 4th Avenue, Suite 306
Anchorage, AK 99501**

Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska

Table of Contents

Summary

Introduction	3
Overview of “Stock Assessment Section”	7
Overview of Appendices	29

Stock Assessment Section

1. Walleye pollock	41
2. Pacific cod	155
3. Sablefish	245
4. Flatfish	317
Dover sole	351
5. Rex sole	399
6. Arrowtooth flounder	435
7. Flathead sole	473
8. Pacific ocean perch	525
9. Northern rockfish	579
10. Rougheye rockfish	641
11. Shortraker and other slope rockfish	685
12. Pelagic shelf rockfish	727
13. Demersal shelf rockfish	781
14. Thornyhead rockfish	825
15. Atka mackerel	861
16. Skates	881

Appendix A. Forage fish	927
-------------------------------	-----

Appendix B: Definitions of Common Acronyms	957
--	-----

Ecosystem Considerations	Bound separately
--------------------------------	------------------

Economic Status of Groundfish Fisheries off Alaska	Bound separately
--	------------------

Summary

by

The Plan Team for the Groundfish Fisheries of the Gulf of Alaska

Introduction

The *National Standard Guidelines for Fishery Management Plans* published by the National Marine Fisheries Service (NMFS) require that a stock assessment and fishery evaluation (SAFE) report be prepared and reviewed annually for each fishery management plan (FMP). The SAFE reports are intended to summarize the best available scientific information concerning the past, present, and possible future condition of the stocks and fisheries under federal management. The FMPs for the groundfish fisheries managed by the Council require that drafts of the SAFE reports be produced each year in time for the December North Pacific Fishery Management Council (Council) meetings.

The SAFE report for the Gulf of Alaska (GOA) groundfish fisheries is compiled by the Plan Team for the Gulf of Alaska Groundfish FMP from chapters contributed by scientists at NMFS Alaska Fisheries Science Center (AFSC) and the Alaska Department of Fish and Game (ADF&G). The stock assessment section includes recommended acceptable biological catch (ABC) levels for each stock and stock complex managed under the FMP. The ABC recommendations, together with social and economic factors, are considered by the Council in determining total allowable catches (TACs) and other management strategies for the fisheries.

The GOA Groundfish Plan Team met in Seattle on November 14-18th, 2005 to review the status of stocks of seventeen species or species groups that are managed under the FMP. The Plan Team review was based on presentations by ADF&G and NMFS AFSC scientists with opportunity for public comment and input. Members of the Plan Team who compiled the SAFE report were James Ianelli and Diana Stram (co-chairs), Sandra Lowe, Jeff Fujioka, Jon Heifetz, Ken Goldman, Bob Foy, Bill Clark, Sarah Gaichas, Victoria O'Connell, Tom Pearson, Nick Sagalkin, and Theresa Tsou.

Background Information

Management Areas and Species

The Gulf of Alaska (GOA) management area lies within the 200-mile U.S. Exclusive Economic Zone (EEZ) of the United States (Figure 1). Five categories of finfishes and invertebrates have been designated for management purposes. They are: target species, other species, prohibited species, forage fish species and non-specified species. This SAFE report describes stock status of target species only. Species or complexes included in each of the first three categories are listed below.

Target Species	Other Species	Prohibited Species
Pollock	Octopi	Pacific halibut
Pacific cod	Squids	Pacific herring
Flatfishes	Sculpins	Pacific salmon
Rockfishes	Sharks	Steelhead trout
Sablefish		King crabs
Atka mackerel		Tanner crabs
Skates		

No specifications are set for forage fish and catch records need not be kept. All other species of fish and invertebrates taken incidentally that are not managed by other FMPs and are associated with groundfish fisheries are designated as "non-specified species". No specifications are set and catch records need not be kept. A species or species group from within the target species category may be split out and assigned

an appropriate harvest level. Similarly, species in the target species category may be combined and a single harvest level assigned to the new aggregate species group. The harvest level for demersal shelf rockfish in the Eastern Regulatory Area is specified by the Council each year. However, management of this fishery is deferred to the State of Alaska with Council oversight.

The GOA FMP recognizes single species and species complex management strategies. Single species management is recommended for stocks that are easily targeted by the harvesting sector and for which minimal mixing of other species occurs in the targeted catch. In the Gulf of Alaska, Pacific cod, pollock, sablefish, Pacific ocean perch, thornyhead rockfish, flathead sole, rex sole, arrowtooth flounder, northern rockfish, rougheye rockfish, shortraker rockfish, and Atka mackerel are managed as single species. Other groundfish species that are usually caught in groups have been managed as complexes (also called assemblages). For example, other slope rockfish, pelagic shelf rockfish, demersal shelf rockfish, deepwater flatfish, shallow water flatfish, and “other species” have been managed within complexes.

The FMP authorizes splitting species, or groups of species, from the complexes for purposes of promoting the goals and objectives of the FMP. Atka mackerel was split out from “other species” beginning in 1994. In 1998, black and blue rockfish were removed from the GOA FMP and management was deferred to ADF&G. Beginning in 1999, osmerids (eulachon, capelin and other smelts) were removed from the “other species” category and placed in a separate forage fish category (an updated assessment is included this year to address ecosystem considerations). In 2004, Amendment 63 to the FMP was approved which moved skates from the other species category into a target species category whereby individual OFLs and ABCs for skate species and complexes could be established.

Groundfish catches are managed against TAC specifications for the EEZ and near coastal waters of the GOA. State of Alaska internal water groundfish populations are not surveyed by NMFS and catches from internal water fisheries should not be counted against the TAC. The Team has recommended that these catches represent unassessed fish, and should not be counted against an ABC or TAC. Beginning in 2000, the pollock assessment has incorporated the ADF&G survey pollock biomass, therefore, the Plan Team acknowledges that it would be appropriate to reduce the Western (W), Central (C) and West Yakutat (WY) combined GOA pollock ABC by the anticipated Prince William Sound (PWS) harvest level for the State fishery. Therefore, the 2005 PWS GHF of 910 mt should be deducted from the W/C/WY pollock ABC before area apportionments are made.

The Plan Team has provided subarea ABC recommendations on a case by case basis since 1998 based on the following rationale. The Plan Team recommended splitting the EGOA ABC for species/complexes that would be disproportionately harvested from the West Yakutat area by trawl gear. The Team did not split EGOA ABCs for species that were prosecuted by multi-gear fisheries or harvested as bycatch. For those species where a subarea ABC split was deemed appropriate, two approaches were examined. The point estimate for WY biomass distribution based on survey results was recommended for seven species/complexes to determine the WY and East Yakutat/Southeast Outside subarea ABC splits. For some species/complexes, a range was recommended bounded by the point estimate and the upper end of the 95% confidence limit from all three surveys. The rationale for providing a range was based on a desire to incorporate the variance surrounding the distribution of biomass for those species/complexes that could potentially be constrained by the recommended ABC splits.

No Split	Split, Point Estimate	Split, Upper 95% CI
Pacific cod	Pollock	Pacific ocean perch
Atka mackerel	Sablefish	Pelagic shelf rockfish
Shortraker/rougheye	Deep-water flatfish	
Thornyhead	Shallow-water flatfish	
Northern rockfish	Rex sole	
Demersal shelf rockfish	Arrowtooth flounder	
	Flathead sole	
	Other slope rockfish	

New data summary

Since the Stock Assessment and Fishery Evaluation Report (SAFE) for 2005 was issued (NPFMC 2004), the following new information has been incorporated in the stock assessments:

- 1) Pollock: (a) total catch and age composition from the 2004 fishery; (b) biomass and age composition from the 2005 Shelikof Strait echo integration trawl (EIT) survey; (c) 2004 age composition and 2005 biomass and length composition from the 2004 and 2005 ADF&G coastal trawl surveys, respectively.
- 2) Pacific cod: (a) size composition data from the 1977 fisheries, size composition data from the 2004 and preliminary estimates for the 2005 fisheries; (b) biomass and size composition data from the 2005 GOA bottom trawl survey; (c) age composition data from the 2003 GOA bottom trawl survey; d) length-at-age data from the 2003 GOA bottom trawl survey; e) a new maturity-at-length schedule.
- 3) Sablefish: (a) relative abundance and length data from the 2005 longline survey, (b) relative abundance and length data from the 2004 longline fishery, and (c) age data from the 2004 longline survey and longline fisheries.
- 4) Flatfish: updated information from the 2005 GOA bottom trawl survey was presented for deep water flatfish and shallow water flatfish. It is noted that the 2005 survey only extended to 700 m while the distribution of deep water flatfish species extends deeper. For Dover sole the following information was updated: (a) biomass and size composition data from the 2005 GOA bottom trawl survey; and b) 2004 fishery length data.
- 5) Rex sole: a) an age-structured model which was first presented in 2004, was utilized for ABC and OFL recommendations; b) biomass and size composition data from the 2005 GOA bottom trawl survey; and c) 2004 fishery length data.
- 6) Arrowtooth flounder: a) biomass and size composition data from the 2005 GOA bottom trawl survey; b) updated 2003 fishery length data and 2004 and 2005 fishery length data; and c) age composition data from the 1999, 2001, and 2003 GOA bottom trawl surveys.
- 7) Flathead sole: a) biomass and size composition data from the 2005 GOA bottom trawl survey; b) 2004 fishery length data; and c) age composition data from the 2003 GOA bottom trawl survey.
- 8) Pacific ocean perch: a) 2004 fishery age compositions; b) 2003 trawl survey age compositions; and c) the 2005 GOA bottom trawl survey biomass estimate.
- 9) Northern rockfish: a) 2004 fishery age compositions; b) 2003 trawl survey age compositions; and c) the 2005 GOA bottom trawl survey biomass estimate. Five model alternatives were presented with author recommended Model 5 containing (a) separate survey and fishery selectivity estimation, (b) estimation of natural mortality, and (c) estimation of historic fishing mortality.
- 10) Rougheye rockfish: Rougheye rockfish are now a new chapter in the SAFE document, whereas before they were in a combined document with shortraker and other slope rockfish. Rougheye has been assessed with an age-structured model since 2004. New data include a) the 2003 trawl survey age compositions, and b) 2005 trawl and longline survey biomass estimates and size compositions. Two alternative models presented. Author recommended model contains new age error matrix developed specifically for rougheye rockfish and revised estimate of catch history.
- 11) Shortraker and other slope rockfish: the 2005 survey biomass estimates were used for computing exploitable biomass for shortraker and other slope rockfish.

- 12) Pelagic shelf rockfish: The 2005 GOA bottom trawl survey estimates and a new natural mortality estimate were used for computing exploitable biomass for dark, widow, and yellowtail rockfish. For dusky rockfish, a) 2005 GOA bottom trawl survey estimates; b) 2004 fishery age composition data; c) 2005 fishery lengths; and d) a new model was presented with an updated age-length transition matrix and a new natural mortality estimate.
- 13) Demersal shelf rockfish: a) new estimates of yelloweye rockfish density for the Southern Southeast Outside (SSEO) area from the 2005 survey; b) updated yelloweye average weight and standard error data based on 2004 and winter 2005 port samples; c) age from the 2003 and 2004 fisheries.
- 14) Thornyheads: a) biomass and size composition data from the 2005 GOA bottom trawl survey; b) relative population numbers and weights from the 2004 and 2005 longline surveys.
- 15) Atka mackerel: a) length and age data from the 2003 and 2004 GOA fisheries; and b) biomass and size composition data from the 2003 and 2005 GOA bottom trawl surveys.
- 16) Skates: a) biomass estimates from the 2005 GOA bottom trawl survey; and b) updated life history information.
- 17) Groundfish, generally: Updated catch data from the NMFS Observer Program and Regional Office for 2004 and through November 5th, 2005. The 2005 biennial GOA bottom trawl survey and the annual NMFS longline survey provided abundance indices and biological information for a number of key groundfish species.

Biological Reference Points

A number of biological reference points are used in this SAFE. Among these are the fishing mortality rate (F) and stock biomass level (B) associated with MSY (F_{MSY} and B_{MSY} , respectively). Fishing mortality rates reduce the level of spawning biomass per recruit to some percentage P of the pristine level ($F_{P\%}$). Fishing mortality rate reduces the slope of the yield per recruit curve (plotted against F) to 10% of the slope at the origin ($F_{0.1}$). The fishing mortality rate used to compute ABC is designated F_{ABC} , and the fishing mortality rate used to compute the overfishing level (OFL) is designated F_{OFL} .

Definition of Acceptable Biological Catch and the Overfishing Level

Amendment 56 to the GOA Groundfish FMP, approved by the Council in June 1998, defines ABC and OFL for the GOA groundfish fisheries. The new definitions are shown below, where the fishing mortality rate is denoted F , stock biomass (or spawning stock biomass, as appropriate) is denoted B , and the F and B levels corresponding to MSY are denoted F_{MSY} and B_{MSY} respectively.

Acceptable Biological Catch is a preliminary description of the acceptable harvest (or range of harvests) for a given stock or stock complex. Its derivation focuses on the status and dynamics of the stock, environmental conditions, other ecological factors, and prevailing technological characteristics of the fishery. The fishing mortality rate used to calculate ABC is capped as described under “overfishing” below.

Tier	<p>1) Information available: <i>Reliable point estimates of B and B_{MSY} and reliable pdf of F_{MSY}.</i></p> <p>1a) Stock status: $B/B_{MSY} > 1$ $F_{OFL} = \mu_A$, the arithmetic mean of the pdf $F_{ABC} \leq \mu_H$, the harmonic mean of the pdf</p> <p>1b) Stock status: $\alpha < B/B_{MSY} \leq 1$ $F_{OFL} = \mu_A \times (B/B_{MSY} - \alpha)/(1 - \alpha)$ $F_{ABC} \leq \mu_H \times (B/B_{MSY} - \alpha)/(1 - \alpha)$</p> <p>1c) Stock status: $B/B_{MSY} \leq \alpha$ $F_{OFL} = 0$ $F_{ABC} = 0$</p> <p>2) Information available: <i>Reliable point estimates of B, B_{MSY}, F_{MSY}, $F_{35\%}$, and $F_{40\%}$.</i></p> <p>2a) Stock status: $B/B_{MSY} > 1$ $F_{OFL} = F_{MSY}$ $F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%})$</p> <p>2b) Stock status: $\alpha < B/B_{MSY} \leq 1$ $F_{OFL} = F_{MSY} \times (B/B_{MSY} - \alpha)/(1 - \alpha)$ $F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%}) \times (B/B_{MSY} - \alpha)/(1 - \alpha)$</p> <p>2c) Stock status: $B/B_{MSY} \leq \alpha$ $F_{OFL} = 0$ $F_{ABC} = 0$</p> <p>3) Information available: <i>Reliable point estimates of B, $B_{40\%}$, $F_{35\%}$, and $F_{40\%}$.</i></p> <p>3a) Stock status: $B/B_{40\%} > 1$ $F_{OFL} = F_{35\%}$ $F_{ABC} \leq F_{40\%}$</p> <p>3b) Stock status: $\alpha < B/B_{40\%} \leq 1$ $F_{OFL} = F_{35\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$ $F_{ABC} \leq F_{40\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$</p> <p>3c) Stock status: $B/B_{40\%} \leq \alpha$ $F_{OFL} = 0$ $F_{ABC} = 0$</p> <p>4) Information available: <i>Reliable point estimates of B, $F_{35\%}$, and $F_{40\%}$.</i> $F_{OFL} = F_{35\%}$ $F_{ABC} \leq F_{40\%}$</p> <p>5) Information available: <i>Reliable point estimates of B and natural mortality rate M.</i> $F_{OFL} = M$ $F_{ABC} \leq 0.75 \times M$</p> <p>6) Information available: <i>Reliable catch history from 1978 through 1995.</i> $OFL =$ the average catch from 1978 through 1995, unless an alternative value is established by the SSC on the basis of the best available scientific information $ABC \leq 0.75 \times OFL$</p>
-------------	---

Overfishing is defined as any amount of fishing in excess of a prescribed maximum allowable rate. This maximum allowable rate is prescribed through a set of six tiers which are listed below in descending order of preference, corresponding to descending order of information availability. The SSC will have final authority for determining whether a given item of information is reliable for the purpose of this definition, and may use either objective or subjective criteria in making such determinations. For tier (1), a pdf refers to a probability density function. For tiers (1-2), if a reliable pdf of B_{MSY} is available, the preferred point estimate of B_{MSY} is the geometric mean of its pdf. For tiers (1-5), if a reliable pdf of B is available, the preferred point estimate is the geometric mean of its pdf. For tiers (1-3), the coefficient α is set at a default value of 0.05, with the understanding that the SSC may establish a different value for a specific stock or stock complex as merited by the best available scientific information. For tiers (2-4), a designation of the form " $F_{X\%}$ " refers to the F associated with an equilibrium level of spawning per recruit (SPR) equal to X% of the equilibrium level of spawning per recruit in the absence of any fishing. If reliable information sufficient to characterize the entire maturity schedule of a species is not available, the SSC may choose to view SPR calculations based on a knife-edge maturity assumption as reliable. For tier (3), the term $B_{40\%}$ refers to the long-term average biomass that would be expected under average recruitment and $F=F_{40\%}$.

Overview of Stock Assessments

The current status of individual groundfish stocks managed under the FMP is summarized in this section.

The abundances of Pacific cod, Dover sole, flathead sole, arrowtooth flounder, Pacific ocean perch, roughey rockfish, northern rockfish, and dusky rockfish are above target stock size. The abundances of pollock and sablefish are below target stock size. The relative abundances of other deep-water flatfish,

shallow-water flatfish, rex sole, shortraker rockfish, demersal shelf rockfish, other pelagic shelf rockfish, other slope rockfish, thornyhead rockfish, Atka mackerel, and skates are unknown.

Summary and Use of Terms

Tables 1 and 2 provide a summary of the current status of the groundfish stocks, including catch statistics, ABCs, and TACs for 2005, and recommendations for ABCs and overfishing levels (OFLs) for 2006 and 2007. The added year was included to assist NMFS management since the TAC setting process allows for a period of up to two years to review harvest specifications. Fishing mortality rates (F) and OFLs used to set these specifications are listed in Table 3. ABCs and TACs are specified for each of the Gulf of Alaska regulatory areas illustrated in Figure 1. Table 4 provides a list of species for which the ABC recommendations are below the maximum permissible. Table 5 provides historical groundfish catches in the GOA, 1956-2005.

The sum of the preliminary 2006, 2007 ABCs for target species are 512,125 mt (2006), 473,000 mt (2007) which are within the FMP-approved optimum yield (OY) of 116,000 - 800,000 mt for the Gulf of Alaska. The sum of 2006 and 2007 OFLs are 631,293 mt and 582,477 mt, respectively. The Team notes that because of halibut bycatch mortality considerations in the high-biomass flatfish fisheries, an overall OY for 2006 will be considerably under this upper limit. For perspective, the sum of the 2005 TACs was 291,298 mt, and the sum of the ABCs was 539,263 mt.

The following conventions in this SAFE are used:

- (1) “Fishing mortality rate” refers to the full-selection F (i.e., the rate that applies to fish of fully selected sizes or ages). A full-selection F should be interpreted in the context of the selectivity schedule to which it applies.
- (2) For consistency and comparability, “exploitable biomass” refers to projected age+ biomass, which is the total biomass of all cohorts greater than or equal to some minimum age. The minimum age varies from species to species and generally corresponds to the age of recruitment listed in the stock assessment. Trawl survey data may be used as a proxy for age+ biomass. The minimum age (or size), and the source of the exploitable biomass values are defined in the summaries. These values of exploitable biomass may differ from listed in the corresponding stock assessments if the technical definition is used (which requires multiplying biomass at age by selectivity at age and summing over all ages). In those models assuming knife-edge recruitment, age+ biomass and the technical definitions of exploitable biomass are equivalent.
- (3) The values listed as 2004 and 2005 ABCs correspond to the values (in mt) approved by NMFS. The Council TAC recommendations for pollock were modified to accommodate revised area apportionments in the measures implemented by NMFS to mitigate pollock fishery interactions with Steller sea lions and for Pacific cod removals by the State water fishery of not more than 25% of the Federal TAC. The values listed for 2006 and 2007 correspond to the Plan Team recommendations.
- (4) The exploitable biomass for 2004 and 2005 that are reported in the following summaries were estimated by the assessments in those years. Comparisons of the projected 2006 biomass with previous years’ levels should be made with biomass levels from the revised hindcast reported in each assessment.
- (5) The values used for 2006 were either rolled over (typically for Tier 4 and below) or based on projections. Note that projection values often assume catches and hence their values are likely to change (as are the Tier 4 and lower numbers when new data become available).

Two year OFL and ABC Determinations

Amendment 48 to the GOA groundfish FMP made two significant changes with respect to the stock assessment process. First, since new data during years when no groundfish surveys are conducted are limited, annual assessments are no longer required for long-lived GOA species. These species include the rockfishes, flatfishes, and Atka mackerel. In 2005 a GOA groundfish survey was conducted therefore full assessments for all species are presented in this SAFE report. The second significant change is that the proposed and final specifications can be specified for a period of up to two years. This requires providing ABC and OFL levels for 2006 and 2007. The projection model was modified this year to better accommodate likely mortalities for future OFL and ABC calculations. Also, the projection code was generalized so that it could accommodate all age-structured assessment model types.

In September of this year, preliminary projections of ABC and OFL for 2006 and 2007 were made on the basis of last year's stock assessments. In this SAFE report, the Plan Team has revised most of those projections (Table 1). Such revisions are typically due to the development of new models; collection of new catch, survey, age composition, or size composition data; or use of new methodology for recommending ABC.

In the case of stocks managed under Tier 3, 2006 and 2007 ABC projections are typically based on the output for Scenarios 1 or 2 from the standard projection model. Projections for 2006 OFL are based on the output for Scenario 6 from the standard projection model. Accurate projections for 2007 OFL, however, require a modification of Scenario 6, because Scenario 6 assumes that catch in each year of the projection will equal OFL. Because it is very likely that the actual catch in 2006 (or any year, for that matter) will be substantially less than OFL, projections of 2007 OFL were based on a modification of Scenario 6 in which projected catch for 2006 is fixed at the chapter author's best estimate. For example, if the actual catch for a particular species is typically close to the ABC, the author might set 2006 catch equal to the recommended ABC. Alternatively, if the actual catch for a particular species is typically much less than ABC, the author might set the 2006 catch equal to the recent average catch.

In the case of stocks managed under Tiers 4-6, 2007 projections are set equal to the Plan Team's recommended values for 2006.

The 2007 ABC and OFL values recommended in next year's SAFE report are likely to differ from this year's projections for 2007, for the same reasons that the 2006 projections in this SAFE report differ from those made in September.

Ecosystem Considerations-Gulf of Alaska

This overview has been added to emphasize the increased treatment of ecosystem considerations in annual SAFE reports. A general description of the ecosystems considerations chapter highlighting recent concerns and trends is summarized below. The explicit incorporation of ecosystem assessment data and modeling results in specific stock assessment chapters is also summarized. Additional information is available in individual stock assessment chapters and the ecosystem considerations chapter.

The ecosystem considerations chapter consists of three sections: ecosystem assessment, ecosystem status indicators, and ecosystem-based management indices and information. The ecosystem assessment section, introduced in 2003, combines information from the stock assessment chapters with the two other sections of this chapter to summarize the climate and fishery effects.

Recent trends highlighted in the ecosystem considerations chapter include:

- Surface air temperature variability in the North Pacific in the atmosphere—ocean system is richer than previously understood.
- 2004 – 2005 was a weak El Nino year but the 2005 GOA summer sea surface temperature was the highest on record.
- Larval fish distributions affected by seasonal environmental conditions.

- Studies have confirmed that the biological community shifted after the 1977 climate shift and that new reorganization of the fish and invertebrate populations since 1998 are not apparent.
- Seabird abundances showed either no trends or decreasing trends.
- Steller sea lion non-pup counts increased in western GOA while slightly declining in the central GOA. Eastern GOA counts have not changed since 2002.
- Groundfish populations showing decreasing production (Annual Surplus Production) trends. Groundfish species richness and diversity increased on average. The contributing author noted that “It is unclear whether existing levels of precaution implemented at the single-species level will be sufficient to deal with declines in overall system productivity when trying to meet multi-species or ecosystem objectives”.
- Salmon and herring bycatch increased during 2002 – 2004.

Three stock assessments incorporated information from the ECOPATH model: walleye pollock, thornyhead rockfish, and skates. All three assessments reported diet composition and total consumption on prey species. The pollock assessment further evaluated the impacts of perturbation in pollock abundance and pollock fishery on other species in the Gulf of Alaska ecosystem. In general, pollock abundance is positively correlated to abundances of Steller sea lions, arrowtooth flounder, halibut, and Pacific cod. Although arrowtooth flounder is responsible for more than one third of pollock mortality, this positive relationship between arrowtooth and pollock is not as strong as that between Steller sea lions and pollock. It was noted that Steller sea lion abundance is negatively correlated to arrowtooth flounder and halibut.

The following table summarizes the ecosystem considerations data documented within each species or complex assessment. Data were assessed as being “briefly” described, “evaluated” with an ecosystem indicators table, or quantified using a “model” to describe trophic interactions and environmental interactions.

Species/Assemblage	Ecosystem Effects on Stock			Fishery Effects on Ecosystem		
	Prey	Predator	Abiota	Bycatch	Discard	Abiota
	Desc. Quant.	Desc. Quant.	Desc. Quant.	Desc. Quant.	Desc. Quant.	Desc. Quant.
Walleye pollock	model	model		model	model	
Pacific cod	briefly	briefly		spp comp		
Sablefish	eval.	eval.	briefly	spp comp	eval.	briefly
Deep water flatfish complex	briefly	briefly		briefly	briefly	
Shallow water flatfish complex	briefly	briefly		briefly	briefly	
Rex sole	briefly	briefly		briefly	briefly	
Arrowtooth flounder	briefly	briefly		briefly		
Flathead sole	briefly	briefly		briefly	briefly	
Pacific ocean perch	eval.	eval.	briefly	eval.	eval.	briefly
Northern rockfish	briefly	briefly		eval.	average	
Shortraker and Other slope	eval.	eval.		eval.		briefly
Rougheye rockfish	eval.	eval.	briefly	eval.	eval.	briefly
Pelagic shelf rockfish	eval.	eval.	briefly	eval.	eval.	briefly
Light dusky rockfish						
Dermersal shelf rockfish	eval.	eval.	briefly	eval.	eval.	briefly
Thornyhead rockfish	model	model	briefly	eval.	eval.	briefly
Atka mackerel	briefly					
Skates	model	model	briefly	eval.	eval.	briefly
Forage fish						

Stock status summaries

1. *Walleye Pollock*

Status and catch specifications (mt) of pollock and projections for 2006 and 2007. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2006 and 2007 are those recommended by the Plan Team. Catch data are current through November 5, 2005. The W/C/WYK ABC for 2007 is projected assuming 2006 catch equals 81,300 mt. Similarly, the OFL value for 2007 assumes that the 2006 catch equals the 2006 OFL (110,100 mt). Note that the projections for 2007 are subject to change in 2006. The 2006 and 2007 ABCs are reduced by 910 mt to accommodate the anticipated Prince William Sound GHL.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
GOA	2004	769,420	99,750	71,260	71,260	62,826
	2005	765,180	153,030	91,710	91,710	80,181
	2006	635,732	118,309	86,547		
	2007		97,709	70,307		
W/C/WYK	2004	740,440	91,060	64,740	64,740	62,826
	2005	736,200	144,340	85,190	85,190	80,181
	2006	608,370	110,100	80,390		
	2007		89,500	64,150		
EYK/SEO	2004	28,980	8,690	6,520	6,520	0
	2005	28,980	8,690	6,520	6,520	0
	2006	27,362	8,209	6,157		
	2007		8,209	6,157		

The age-structured model developed using AD Model Builder and used for GOA pollock assessments in 1999-2004 is fundamentally unchanged. This year's pollock chapter features the following new data: (1) total catch and age composition from the 2004 fishery; (2) biomass and age composition from the 2005 Shelikof Strait echo integration trawl (EIT) survey; (3) biomass and length composition from the 2005 ADF&G crab/groundfish trawl survey; and (4) 2005 bottom trawl survey biomass and size composition data. The ecosystem considerations section was also substantially updated.

The ecosystem considerations presented this year confirmed that pollock are an important prey species in the GOA, especially for Pacific halibut, Steller sea lions, arrowtooth flounder and Pacific cod. Analyses of food habits collections from 1990 through 2005 combined with estimates of predator consumption rates suggest that consumption of pollock by arrowtooth flounder is substantial, and consumption by arrowtooth, halibut, and cod combined accounted for the majority of pollock consumption in the ecosystem. While arrowtooth flounder cause the highest proportion of pollock mortality, they are less dependent on pollock than halibut and sea lions because pollock represent a relatively small proportion of the arrowtooth diet. Therefore, while a pollock decline might influence biomass trends for halibut, it is unlikely to do so for arrowtooth. Model simulations indicate that increased pollock mortality had stronger effects on halibut (and the halibut fishery) and sea lions than on arrowtooth flounder or other predators. The Plan Team discussed how predation mortality could be used in future pollock stock assessments and harvest strategies. They agreed with the authors' recommendation to examine results of forthcoming Management Strategy Evaluation (MSE) analyses and ecosystem modeling results to determine how best to proceed.

Recent results from different surveys did not indicate any consistent trend in pollock biomass. The 2005 NMFS bottom trawl survey biomass estimate decreased 10% from the 2003 estimate. The 2005 Shelikof Strait EIT survey biomass estimate remained similar to the 2004 estimate, but the biomass was redistributed, appearing higher near Kodiak and lower in the Western GOA. Biomass estimates of Shelikof Strait fish ≥ 43 cm (a proxy for spawning biomass) increased by 78% from the 2004 estimate, primarily due to maturation of the relatively strong 1999 and 2000 year classes and the redistribution of

biomass towards the Central GOA. The 2005 ADF&G crab/groundfish survey biomass estimate decreased 20% from 2004.

The stock assessment authors evaluated four models: Model 1 estimated the NMFS trawl survey catchability; Model 2 fixed trawl survey catchability at 1.0 (similar to previous assessments) and estimated other catchabilities; Model 3 was similar to Model 2, except that the weights used to fit the model to the ADF&G survey time series were reduced; Model 4 was similar to Model 2, except that the weights used to fit the model to the EIT survey time series were reduced.

The Plan Team agrees with the authors' concerns about the apparent lack of strong recruitment since the 1999 and 2000 year classes, and the projected decline in biomass after 2006. The Plan Team in particular concurred with the authors' choice of Model 2 configuration for assessment results, because fixing $Q=1.0$ results in a more precautionary estimate of spawning biomass and therefore ABC than Model 1, which estimated Q to be less than 1.0. Furthermore, the Plan Team accepted the author's adjusted ABC based on Model 2, which is reduced from the maximum permissible ABC using the "constant buffer" approach first accepted in the 2001 GOA pollock assessment. **Therefore, the ABC for 2006 based on this precautionary model configuration and adjusted harvest control rule is 80,390 mt ($F_{ABC}=0.20$) for GOA waters west of 140 degrees W. longitude** (Note that this ABC recommendation includes the 910 mt for Prince William Sound).

Model 2 results produced an estimated 2006 spawning biomass of 193,092 mt, or 35% of unfished spawning biomass. The $B_{40\%}$ estimate is 224,000 mt. Because model estimated 2006 female spawning biomass is below $B_{40\%}$, Gulf of Alaska pollock are in Tier 3b. The projected 2006 age-3+ biomass estimate is 608,370 mt. Markov Chain Monte Carlo analysis indicated the probability of the stock being below $B_{20\%}$ to be less than 1% in 2006 and subsequent years. The 2006 OFL under Tier 3b is 110,100 mt ($F_{OFL}=0.27$). Spawning biomass is projected to decline after 2006 until at least 2008 due to a lack of significant recruitment since the 2000 year class. While there are some indications of a potentially strong 2004 year class, it is not included in projections at this time.

New survey information was available from the 2005 GOA bottom trawl survey for pollock east of 140 degrees W. longitude (Southeast Alaska). Southeast Alaska pollock are in Tier 5 and the ABC and OFL recommendations based on natural mortality (0.30) and the biomass from the 2005 survey: **This results in a 2006 ABC of 6,157 t (27,362 t * 0.75 M), and a 2006 OFL of 8,209 t (27,362 t * M)**. Since no new survey data will be available until summer of 2007, the 2007 ABC and OFL should be set equal to the 2006 values for the E.Yak/SE area.

Area apportionments, including deduction of 910 mt for the state managed pollock fishery in Prince William Sound, are tabulated below.

Area apportionments for 2006 and 2007 pollock ABCs for the Gulf of Alaska (mt).						
Year	610	620	630	640	650	
	W	Central	Central	W. Yakutat	E.Yak/SE	Total
2006	29,187	30,775	18,619	1,809	6,157	86,547
2007	23,291	24,558	14,858	1,443	6,157	70,307

2. *Pacific Cod*

Status and catch specifications (mt) of Pacific cod and projections for 2006 and 2007. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. ABC and OFL for 2007 are projected assuming 2006 catch equals the 2006 ABC. Catch includes state management fisheries current through 11/05/2005.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
GOA	2004	501,000	102,000	62,810	41,076	43,104
	2005	472,000	86,200	58,100	44,433	33,462
	2006	453,000	95,500	79,618		
	2007		59,100	49,466		

Three alternative models were presented. Model 1 was identical to last year's model, which was developed using the Stock Synthesis 1 assessment software that has formed the basis of the GOA Pacific cod model since 1994. Models 2 and 3 were developed under the new Stock Synthesis 2 (SS2) assessment software, which uses automatic differentiation (via the ADMB programming language). In addition, Stock Synthesis 1 and Stock Synthesis 2 differ with respect to several technical details. The primary difference between Model 2 and Model 3 is that Model 2 fixes the natural mortality rate M and the EBS bottom trawl survey catchability coefficient Q at values of 0.37 and 1.00, respectively (identical to the values assumed in Model 1), whereas Model 3 allows the values of these two parameters to be estimated internally.

There were several changes in the input data:

- 1) Catch data for 1964-1977 were incorporated, catch data for 2004 were updated, and preliminary catch data for 2005 were incorporated.
- 2) Size composition data from the 1977 commercial fisheries were incorporated, size composition data from the 2004 commercial fisheries were updated, and preliminary size composition data from the 2005 commercial fisheries were incorporated.
- 3) Size composition data from the GOA bottom trawl survey were incorporated.
- 4) The biomass estimate from the GOA bottom trawl survey was incorporated (the 2005 estimate of 308,102 t was up about 4% from the 2003 estimate).
- 5) Age composition data from the 2003 GOA bottom trawl survey were incorporated.
- 6) Length-at-age data from the 2003 GOA bottom trawl survey were incorporated.
- 7) A new maturity-at-length schedule was incorporated.

From 1995 through 2004, the maturity schedule used in the assessments was based on visual determinations of maturity by observers from the 1994 fishery (length at 50% maturity was 67 cm). For this year's assessment, the maturity schedule is based on a new study that used histology from samples collected in the central GOA during 1998-2004 (length at 50% maturity is 50 cm). The Plan Team supports the use of the more recent schedule based on histological samples.

The Plan Team discussed at length the authors' selection of Model 3 and noted that for the GOA, Model 2 would be more appropriate based on most of the model evaluation criteria presented. Also, the Team was more comfortable with a more incremental change given that for the GOA, this was the first presentation of the new model. The Team concurred that the new model was an improvement over the previous model (hence did not consider Model 1). However, they requested that the author continue to explore more flexible modeling approaches.

The current biomass in this year's assessment places the GOA Pacific cod stock in Tier 3a. Based on Model 2, the estimated 2006 female spawning biomass for the GOA stock is 116,575 mt, up about 80% from last year's estimate for 2005 and above the $B_{40\%}$ value of 106,779 mt. These changes are due largely to use of the new maturity schedule and not the new modeling approach.

Based on Model 2, the maximum permissible ABC (Tier 3a) for 2006 is 79,618 mt. An ABC of this magnitude would represent an increase of 21,518 mt, or 37%, relative to the 2005 ABC. The assessment notes that the 2001-2003 year classes are almost certainly below average, and that biomass is very likely to decrease in coming years as these cohorts work their way through the age structure. The Plan Team shares the authors' concerns regarding decreases in future biomass and the volatility in future catches that would be expected if the stock were fished at the maximum permissible rate. The Plan Team recommends these values for setting maximum permissible ABC and OFL values, but recognizes that this ABC is quite high and recommends setting TAC to a lower value (e.g., similar to the 2005 ABC). Under the Model 2 maximum permissible ABC for 2006, the 2007 ABC is projected to be drop to 49,466 mt.

The Team's recommendation is to set the 2006 ABC at 79,618 mt (and 49,466 mt for 2007), corresponding to a fishing mortality rate of 0.545. The 2006 OFL under Tier 3a is estimated at 95,500 mt (59,100 mt for 2007), corresponding to a fishing mortality rate of 0.677. The Team concurred with the author's recommendation to apportion the 2006 and 2007 ABC according to the average of biomass distribution in the three most recent surveys:

Apportionment		2006	2007
West	39%	31,051	19,292
Central	55%	43,790	27,206
East	6%	4,777	2,968
Total		79,618	49,466

3. Sablefish (GOA and BSAI)

Status and catch specifications (mt) of sablefish and projections for 2006 and 2007. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. ABC for 2007 is projected assuming 2006 catch equals the ABC, and OFL for 2007 is projected assuming 2006 catch equals the OFL. Catch data are current through 11/05/2005.

Area	Year	Age 4+ biomass	OFL	ABC	TAC	Catch
Gulf of Alaska	2004	179,000	22,160	16,550	16,550	15,630
	2005	185,000	19,280	15,940	15,940	13,654
	2006	152,000	17,880	14,840	---	---
	2007		15,800	13,120	---	---
Bering Sea	2004	32,000	4,020	3,000	2,900	977
	2005	34,000	2,950	2,440	2,440	1050
	2006	31,00	3,680	3,060	---	---
	2007		3,260	2,700	---	---
Aleutians	2004	39,000	4,620	3,450	3,100	918
	2005	34,000	3,170	2,620	2,571	1,486
	2006	33,000	3,740	3,100	---	---
	2007		3,300	2,740	---	---

Sablefish are assessed as a single stock for the GOA and BSAI areas. This year's sablefish assessment contains the following new information: relative abundance and length data from the 2005 longline survey, relative abundance and length data from the 2004 longline fishery, and age data from the 2004 longline survey and longline fisheries.

Fishery CPUE data from 2004 logbooks were not available because of a delay in data entry, so only observer CPUE data for 2004 were used. The protocol to screen commercial CPUE data for whale predation and targeting on other species were revised to get a more consistent index in the Bering Sea.

The final dataset showed good agreement between observer and logbook fishery CPUE. Next year both the 2004 and 2005 logbook data will be available.

Fishery and survey CPUE have changed little since 2000. Survey abundance is 6% higher than the recent low in 2000 and fishery CPUE is the same. Spawning biomass is now moderate at 38% of the unfished level and is projected to remain at that level in 2006. The 2000 year-class appears promising and is forecast to be 19% of spawning biomass in 2006, as is the still important 1997 year-class.

This stock is in Tier 3b. The projected 2006 spawning biomass is 199,300 mt which is 95% of $B_{40\%}$. The maximum permissible F_{ABC} under Tier 3b rules is 0.105 which gives a maximum 2006 ABC of 21,000 mt for all areas combined (GOA and BSAI), the same as last year. The OFL fishing mortality rate is 0.128 which translates into a 2006 OFL (combined areas) of 25,300 mt. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

Area apportionments for the 2006 ABC are based on an agreed 5-year exponential weighting of the survey and fishery indices of abundance in weight. An increase in 2005 in the BS/AI indices resulted in an increase in the proportions assigned to those areas at the expense of the Gulf of Alaska. Area apportionments of sablefish ABC in 2006 (**adjusted for the 95:5 gear split** in the Eastern Gulf of Alaska), and projected ABC and OFL in 2007 are:

Area	2006 ABC	2006 OFL	2007 ABC	2007 OFL
Total	21,000	25,300	18,560	22,360
Bering Sea	3,060	3,680	2,700	3,260
Aleutians	3,100	3,740	2,740	3,300
Gulf of Alaska	14,840	17,880	13,120	15,800
Western	2,670	---	2,360	---
Central	6,370	---	5,630	---
W. Yakutat	2,280	---	2,014	---
E. Yakutat/Southeast	3,520	---	3,116	---

4. Deep water flatfish complex (*Dover sole and others*)

Status and catch specifications (mt) of deep water flatfish (*Dover sole and others*) and projections for 2006 and 2007. Data in this table represent a summation of data from the following tables for Greenland turbot, deep sea sole, and Dover sole. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data in this table are current through 11/05/2005.

Year	Biomass	OFL	ABC	TAC	Catch
2004	99,620	8,010	6,070	6,070	682
2005	102,395	8,490	6,820	6,820	406
2006	132,297	11,008	8,665		
2007	134,079	11,022	8,677		

The deep water flatfish complex is comprised of Dover sole, Greenland turbot, and deep sea sole. Dover Sole are in Tier 3a while both Greenland turbot and deep sea sole are in Tier 6. New data in the deepwater flatfish (*excluding Dover sole*) assessment included data from the 2005 NMFS groundfish survey. It is noted that the survey only extended to 700 m in 2005 while the distribution of each deep water flatfish species extends deeper.

No new changes were made to the assessment methodology.

Ecosystem effects of Greenland turbot and deep sea sole are limited to trophic interactions with benthic organisms. Fishery effects are unknown.

The Tier 6 2006 deep water flatfish complex (which excludes Dover sole) ABC was estimated at 183 mt, which was the same as the 2005 ABC. The 2006 OFL where $OFL = \text{average catch from 1978 to 1995}$ was

estimated at 244 mt. The 2007 ABC and OFL were calculated by setting 2006 catches equivalent to 2005 catches.

Dover sole are managed as a part of the deep water flatfish complex although an age-structured model is used for ABC recommendations. New data in the Dover sole assessment included fishery catch (2004 and 2005) through September 24, 2005, fishery (2004 only) and NMFS groundfish survey lengths (2005), and NMFS groundfish survey biomass estimates (2005). The 2003 age data from the NMFS groundfish survey were as yet unavailable.

Due to concerns over the effect on the assessment model of high 2002 recruitment, the author evaluated constraining recruitment for recent years. The effect of high 2002 recruitment was found to be insignificant; therefore, no new changes were made to the final assessment methodology.

The authors' research priorities included: increased age data, analyses of alternative selectivity estimates, inclusion of survey depth data, and potential inclusion of environmental parameters into the assessment. Ecosystem effects appear to be limited to trophic interactions with benthic organisms and with arrowtooth flounder. Fishery effects include limited bycatch rates of Pacific halibut and crab species.

Age 3+ biomass estimates increased slightly while female spawning biomass estimates continue to remain relatively unchanged. Recruitment appears to have leveled off after a decline between 2002 and 2004. Catches remain well below the TAC. The 2006 ABC using $F_{40\%}=0.142$ was estimated at 8,482 mt, which was 1,842 mt greater than the 2005 ABC. The 2006 OFL using $F_{35\%}=0.184$ was estimated at 10,764 mt. The 2007 ABC and OFL were projected by setting 2006 catches equivalent to 2005 catches. The GOA Plan Team agrees with the authors' recommended ABC which was equivalent to the maximum permissible ABC.

Area apportionments of deep water flatfish (<i>Dover sole and others</i>) ABC's for 2006 and 2007 (using $F_{40\%}$) are based on the fraction of the 2005 survey biomass in each area.					
Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2006	420	4,139	2,661	1,445	8,665
2007	421	4,145	2,665	1,446	8,677

Shallow water flatfish

Status and catch specifications (mt) of shallow water flatfish and projections for 2006 and 2007. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through 11/05/2005.

Year	Biomass	OFL	ABC	TAC	Catch
2004	375,950	63,840	52,070	20,740	3,094
2005	375,950	63,840	52,070	20,740	4,630
2006	365,766	62,418	51,450		
2007	365,766	62,418	51,450		

The shallow water flatfish complex is made up of northern rock sole, southern rock sole, yellowfin sole, butter sole, starry flounder, English sole, sand sole, and Alaska plaice. Northern and southern rock sole are managed in Tier 4 while other shallow-water flatfish are in Tier 5. The only new data for the shallow-water flatfish assessment are the 2005 survey biomass estimates which were used to calculate ABC's for 2006. The 2006 exploitable biomass for each group is based on results from the 2005 NMFS trawl survey. The assessment methodology was unchanged.

Ecosystem effects of shallow-water flatfish are limited to trophic interactions with benthic organisms. Fishery effects are unknown.

The F_{ABC} and F_{OFL} values for southern rock sole were estimated as: $F_{40\%}=0.162$ and $F_{35\%}=0.192$. For northern rock sole the values are: $F_{40\%}=0.204$ and $F_{35\%}=0.245$. Other flatfish ABCs were estimated with $F_{ABC}=0.75 M$ and $F_{OFL}=M$ (Tier 5).

Area apportionments of shallow water flatfish ABC's for 2006 and 2007 (using $F_{40\%}$) are based on the fraction of the 2005 survey biomass in each area.

Western	Central	West Yakutat	East Yakutat/SE	Total
24,720	24,258	628	1,844	51,450

5. Rex Sole

Status and catch specifications (mt) of rex sole and projections for 2006 and 2007. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through 11/05/2005.

Year	Biomass	OFL	ABC	TAC	Catch
2004	99,950	16,480	12,650	12,650	1,464
2005	99,950	16,480	12,650	10,750	2,152
2006	83,600	12,000	9,200		
2007	79,100	11,400	8,700		

In 1993, rex sole were split out of the deep-water flatfish complex because of concerns regarding the Pacific ocean perch bycatch in the rex sole target fishery. Rex sole are assessed using an age-structured model first presented in 2004. New data in the rex sole assessment included survey biomass and length composition (2005), catch biomass (2005), and fishery length data (2004). Reference fishing mortality rates prior to the development of the age structured model were calculated using $F_{ABC}=0.75M$ and $F_{OFL}=M$ (Tier 5).

Initial estimates of $F_{40\%}$ and $F_{35\%}$ were very high causing initial estimates of Tier 3 ABCs in this year's assessment to be 5-times higher than recent year ABCs. Fishing mortality values ($F_{40\%}$ and $F_{35\%}$) were high because the age at 50% selected into the fishery is about 10 years, whereas the age at 50% maturity is only about 5 years. Fishing at the maximum permissible F_{ABC} results in rapidly declining yields and biomass in the next few years. Thus, the Plan Team elected to adopt a Tier 5 approach for ABC recommendation using the model estimates of adult biomass.

Predation by arrowtooth flounder may be limiting the potential rate of increase of rex sole under current conditions, but arrowtooth flounder do not appear to represent a threat to the stock. Fishery effects are unknown.

The 2006 ABC using $F_{ABC} = 0.75M = 0.1275$ was estimated at 9,200 mt. The 2006 OFL using $F_{OFL} = M = 0.17$ gives 12,000 mt. The 2007 ABC and OFL were calculated with 2006 catches equivalent to 2005 catches.

Area apportionments of rex sole ABC's for 2006 (using $F_{40\%}$) are based on the fraction of the 2005 survey biomass in each area.

	Western	Central	West Yakutat	East Yakutat/SE	Total
2006	1,159	5,506	1,049	1,486	9,200
2007	1,096	5,207	992	1,405	8,700

6. Arrowtooth flounder

Status and catch specifications (mt) of arrowtooth flounder and projections for 2006 and 2007. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data in this table are current through 11/05/2005.

Year	Biomass	OFL	ABC	TAC	Catch
2004	2,453,390	228,130	194,930	38,000	15,304
2005	2,453,390	253,900	216,900	38,000	19,264
2006	2,140,170	207,678	177,844		
2007		216,500	185,403		

Arrowtooth flounder biomass is managed as Tier 3a with estimated 2005 female spawning biomass much greater than the $B_{40\%}$ estimate from the age-structured model. Data from halibut trawl surveys in the 1960's, groundfish trawl surveys in the 1970's, and NMFS triennial trawl surveys from 1984 to 2005 were included in the model. New data in the arrowtooth flounder assessment included updated fishery catch and lengths (2003, 2004, and 2005) through October 1, 2005, and survey age data (1999, 2001, and 2003).

No new changes were made to the assessment methodology. Fishery selectivities were estimated using a smoothing function as in the previous assessments. Similarly, natural mortality rates for males were set higher than for females to obtain a sex ratio of about 70% females in the population. Length composition data were fit using a fixed length-age transition matrix estimated from survey length at age data.

The authors' research priorities were: increased age data and analyses of selectivity and catchability. Ecosystem effects suggest that trophic interactions of arrowtooth flounder are very important in the GOA. Specifically, the predation on walleye pollock by arrowtooth flounder appears to be significant. The most relevant fishery effect of the arrowtooth flounder fishery is bycatch of prohibited species; specifically Pacific halibut.

Age 3+ biomass and female spawning biomass estimates continue to increase and recruitment is above average in the GOA. The 2006 ABC using $F_{40\%}=0.142$ was estimated at 177,844 mt, which was 39,100 mt less than the 2005 ABC. The 2006 OFL using $F_{35\%}=0.168$ was estimated at 207,678 mt. The 2007 ABC and OFL were calculated by estimating 2006 catches with the average 5 year $F=0.012$. The GOA Plan Team agrees with authors recommended ABC which was equivalent to maximum permissible ABC.

Area apportionments of arrowtooth flounder ABC's for 2006 and 2007 (using $F_{40\%}$) are based on the fraction of the 2005 survey biomass in each area.

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2006	20,154	134,906	15,954	6,830	177,844
2007	21,011	140,640	16,632	7,120	185,403

7. Flathead sole

Status and catch specifications (mt) of flathead sole for recent years and projections for 2006 and 2007. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data in this table are current through 11/05/2005.

Year	Biomass	OFL	ABC	TAC	Catch
2004	292,670	64,750	51,720	10,880	2,394
2005	292,670	56,500	45,100	10,390	2,515
2006	291,441	47,003	37,820		
2007	298,035	48,763	39,196		

The 2005 exploitable flathead sole biomass is estimated with an age-based model as originally presented in 2002, updated with 2004 catch and fishery length data and 2005 catch data current through 9/10/2005.

The 2005 NMFS groundfish survey biomass estimate and length composition data were added to the model along with 2003 survey age composition data while the corresponding 2003 length data were removed. Maturity parameters were updated. Estimates of fishing mortality were obtained from spawner-per-recruit analysis. The Plan Team concludes that reliable estimates of $B_{40\%}$ exist and that the projected 2006 female spawning biomass was estimated well above the $B_{40\%}$ level. Therefore, flathead sole would be in Tier 3a of the ABC and overfishing definitions. Under this definition, $F_{OFL}=F_{35\%}$, and F_{ABC} is less than or equal to $F_{40\%}$.

Predation by arrowtooth flounder may be limiting the potential rate of increase of flathead sole under current conditions, but arrowtooth flounder do not appear to represent a threat to the stock. The most relevant fishery effect of the flathead sole fishery is bycatch of prohibited species; specifically Pacific halibut.

The 2006 ABC using $F_{40\%} = 0.359$ was estimated at 37,820 mt which is 7,280 mt lower than the 2005 ABC. The 2006 OFL using $F_{35\%} = 0.463$ was estimated at 47,003 mt. The 2007 ABC and OFL were calculated with 2006 catches equivalent to 2005 catches.

Area apportionments of flathead sole ABC's for 2006 and 2007 (using $F_{40\%}$) are based on the fraction of the 2005 survey biomass in each area.					
Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2006	10,548	25,195	2,022	55	37,820
2007	10,932	26,111	2,096	57	39,196

Slope rockfish

Status and catch specifications (mt) of slope rockfish management category and projections for 2006 and 2007. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. For stocks where age-structured assessments are available, ABCs and OFLs for 2006 and 2007 are projected assuming specified catch levels in 2005 and 2006. Catch data are current through 11/05/2005.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Pacific ocean perch	2004	285,066	15,840	13,340	13,340	11,528 11,357
	2005	286,367	16,266	13,575		
	2006	312,968	16,927	14,261		
	2007	315,507	17,152	14,726		
Northern rockfish	2004	104,438	5,790	4,870	4,870 5,093	4,783 4,778
	2005	108,274	6,050	5,093		
	2006	136,311	7,673	5,093		
	2007		7,618	5,093		
Shortraker and roughey rockfish	2004	73,000	2,510	1,318	1,318	998
Shortraker rockfish	2005	32,723	982	753	753	497
	2006	37,461	1,124	843		
	2007	37,461	1,124	843		
Roughey rockfish	2005	40,281	1,531	1,007	1,007	296
	2006	37,449	1,180	983		
	2007		1,161	964		
Other slope rockfish	2004	89,460	6,610	3,900	670	872 764
	2005	89,460	5,150	3,900		
	2006	93,552	5,394	4,152		
	2007	93,552	5,394	4,152		

Area apportionments of ABC for slope rockfish for 2006.						
Species	Western	Central	Eastern	West Yakutat	East Yak./SE	Total
Pacific ocean perch	4,155	7,418	2,688	1,101	1,587	14,261
Northern rockfish	1,483	3,608				5,091
Shortraker rockfish	153	353	337			843
Rougheye rockfish	136	608	239			983
Other slope rockfish	577	386		317	2,872	4,152

Note: other slope rockfish in the Eastern GOA include 2 mt of Northern rockfish.

GOA slope rockfish are in a biennial stock assessment schedule to coincide with new survey data. This year's SAFE chapters consist of full assessments.

8. *Pacific ocean perch*

Status and catch specifications (mt) of Pacific ocean perch and projections for 2006 and 2007. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. ABC for 2007 is projected assuming 2006 estimated catch equal to 11,890 mt. OFL for 2006 is projected assuming 2005 catch equals the OFL. Catch data are current through 11/05/2005.

	Species	Year	Biomass ¹	OFL	ABC	TAC	Catch
	Pacific ocean perch	2004	285,066	15,840	13,340	13,340	11,528
		2005	286,367	16,266	13,575	13,575	11,357
		2006	312,968	16,927	14,261		
		2007	315,507	17,152	14,726		

¹Total biomass from the age-structured model

The generic rockfish model continues to be the primary assessment tool. The model was constructed with AD Model Builder software. The model is a separable age-structured model with allowance for size composition data. The data sets used included total catch biomass for 1961-2005; size compositions from the fishery for 1963-77 and 1991-97; trawl survey age compositions for 1984-2003; fishery age composition for 1990, 1998-2002, 2004; and survey biomass estimates for 1984-2005. New data in the model included the 2003 survey age composition, 2004 fishery age composition, updated 2004 catch, estimated 2005 fishery catch and 2005 survey biomass estimates.

Recent survey biomass estimates are relatively high and more precise compared with those from the early 1990s. This has caused the estimated model biomass to trend upward. The addition of new age data in this year's model, particularly the first survey ages since 1999, has increased recruitment estimates for the 1994 and 1995 year classes and shows potential higher recruitments for the 1999 and 2000 year classes when compared to results from last year's model. However, these recruitments, especially recently, are still highly uncertain.

The ABC is based on Tier 3a. The estimated 2006 female spawning biomass of 93,108 mt is greater than $B_{40\%}$ (90,022 mt), where $B_{40\%}$ is determined from the average recruitment of the 1977-1999 year classes. The estimate of $F_{40\%}$ is 0.062. This gives a maximum permissible ABC level of 14,261 mt which is the authors' and the Plan Team's recommended value. This ABC is 5% higher than last year's ABC of 13,575 mt. The stock is neither overfished, nor approaching an overfished status. The OFL ($F_{35\%} = 0.074$) is 16,927 mt.

The Plan Team discussed the validity of using the maximum allowable ABC for this stock. The Team felt that the maximum permissible ABC is warranted because female spawning biomass is above $B_{40\%}$ and increasing, recent survey biomass indices have remained high, ABCs have remained relatively stable, and there is considerable conservatism built into the stock assessment (e.g., q is > 1.0) and ABC is only about 2% of recent survey biomass estimates.

The authors responded to the SSC requests and discussed some analyses on harvest strategy, localized depletion and age truncation within the document.

The Team and authors also concurred with the method of ABC and OFL apportionment used in the past. This results in weighting of 4:6:9 for the regional distribution biomass in the 2001, 2003, and 2005 surveys, respectively, and area apportionments of 29% for the Western area, 52% for the Central area, and 19% for the Eastern area.

Area apportionment of 2006 ABC and OFL for POP in the Gulf of Alaska:

Year		Western	Central	Eastern	WYAK	SEO	Total
2006	ABC	4,155	7,418	-	1,101	1,587	14,261
2007		4,290	7,660		1,137	1,639	14,726
2006	OFL	4,931	8,806	3,190	-	-	16,927
2007		4,997	8,922	3,223	-	-	17,152

Amendment 41 prohibited trawling in the Eastern area east of 140° W longitude. Since Pacific ocean perch are caught exclusively with trawl gear, there is concern that the entire Eastern area TAC could be taken in the area between 140° and 147° W longitude, that remains open to trawling. Thus, as was done last two years, the Team recommends that a separate ABC be set for Pacific ocean perch in WYAK. This weighted average is based on of the upper 95% confidence interval of the proportion of EG exploitable biomass that occurs in WYAK (0.41). The interval is computed using the weighted average from the 1999, 2003 and 2005 (2001 did not sample the Eastern Gulf). Using the upper 95% confidence interval is an effort to balance uncertainty with associated costs to industry. This corresponds to an ABC of 1,101 mt for WYAK. Under this apportionment strategy, very little of the 1,587 mt assigned to the remaining Eastern area (East Yakutat/Southeast Outside area) will be harvested.

9. Northern Rockfish

Status and catch specifications (mt) of northern rockfish and projections for 2006 and 2007. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. ABC for 2007 is projected assuming 2006 catch equals 4,776 mt, and OFL for 2007 is projected assuming 2006 catch equals the OFL. Catch data are current through 11/05/2005.

Species	Year	Biomass ¹	OFL	ABC	TAC	Catch
Northern rockfish	2004	104,438	5,790	4,870	4,870	4,783
	2005	108,274	6,050	5,093	5,093	4,778
	2006	136,311	7,673	5,091		
	2007		7,618	5,091		

¹Total biomass from the age-structured model

New data in the models were the 2005 survey index of biomass, updated catch from 2004, preliminary catch for 2005, survey age composition from 2003, fishery age compositions from 2003 and 2004, and updated fishery age compositions with additional ages for 2000 – 2002. Fishery length compositions were removed for the years 1998-2003, because fishery age compositions were available for these years.

The stock assessment author evaluated five different model configurations. Three of these configurations were presented for the first time for northern rockfish. The author chose “Model 5” for ABC recommendations because it appeared most consistent with recent survey biomass levels. Relative to the model used in previous assessments, the major changes for Model 5 included estimation of separate survey and fishery selectivity, estimation of natural mortality with an informative prior, and estimation of historical fishing mortality which affected initial numbers at age in 1977. The Plan Team selected Model 4 for this year’s maximum permissible ABC recommendation. This was preferred over Model 5 because natural mortality was fixed and that further evaluations are needed.

Based on Model 4, current female spawning biomass ($B_{2005} = 37,173$ mt) is greater than $B_{40\%}$ (27,688 mt) where $B_{40\%}$ is determined from the average recruitment of the 1977-1999 year classes. The estimate of $F_{40\%}$ is 0.066. Applying Tier 3a results in $F_{ABC} \leq 0.066$ and an $ABC \leq 6,393$ mt. The overfishing level based on Tier 3a ($F_{35\%} = 0.080$) is 7,673 mt.

The Plan Team and the stock assessment authors were concerned that Models 2-5 need additional validation to insure that results are reliable. In particular the effect of including historic fishing mortality on model results needs to be more fully explored. Thus, the Plan Team recommends that the ABC from 2005 be used for 2006. This gives an ABC of 5,093 mt (estimated $F_{ABC}=0.053$). The Plan Team strongly recommended that further model evaluations for the northern rockfish assessment be presented at the September 2006 Plan Team meeting.

Apportioning the ABC based on the same method used for Pacific ocean perch and results in ABCs of 1,483 mt in the Western area and 3,608 mt in the Central area, and 2 mt in the Eastern area. Northern rockfish are combined with other slope rockfish in the Eastern area.

10. Rougheye rockfish

Status and catch specifications (mt) of rougheye rockfish and projections for 2006 and 2007. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through 11/05/2005.

	Species	Year	Biomass ¹	OFL	ABC	TAC	Catch
	Shortraker/Rougheye	2004	73,000	2,510	1,318	1,318	997
	Rougheye rockfish	2005	40,281	1,531	1,007	1,007	296
		2006	37,449	1,180	983		
		2007		1,161	964		

¹Biomass for rougheye rockfish based on trawl surveys for 2004 and model estimates for 2005-2007.

The rougheye rockfish stock is assessed with a separable age-structured model introduced in November 2004. The data sets used include total catch biomass, fishery size compositions, trawl and longline survey biomass estimates and size compositions, and trawl survey age compositions. The recommended model for this year includes an ageing error matrix developed specifically for rougheye rockfish and a revised estimate of the catch history.

The Tier 3a maximum permissible ABC derived from the author's recommended model for 2006 is 983 mt ($F_{ABC}=F_{40\%}=0.039$). The OFL for 2006 is 1,180 mt ($F_{35\%}=0.047$). The Plan Team agrees with the author's recommended ABC, which is about 2% lower than last year's ABC of 1,007 mt. The decrease in ABC is likely due to the decrease in the longline survey relative population weight in the 2005 survey. Recommended 2006 ABC area apportionments are 136 mt for the Western area, 608 mt for the Central area, and 239 for the Eastern area.

The Plan Team recommended that projections for rougheye rockfish in 2007 assume that the full ABC will be taken in 2006.

Area apportionment (calculated using the same method as for POP) of the 2006 and 2007 ABC for rougheye rockfish in the Gulf of Alaska:

	Western	Central	Eastern	Total
2006	136	608	239	983
2007	133	596	235	964

11. Shortraker and other slope rockfish

Shortraker rockfish

Status and catch specifications (mt) of shortraker slope rockfish and projections for 2006 and 2007. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through 11/05/2005.

Species	Year	Biomass ¹	OFL	ABC	TAC	Catch
Shortraker/Rougheye	2004	73,000	2,510	1,318	1,318	998
Shortraker rockfish	2005	32,723	982	753	753	497
	2006	37,461	1,124	843		
	2007	37,461	1,124	843		

¹Exploitable biomass based on trawl surveys for shortraker rockfish.

The assessment of shortraker rockfish is updated with biomass estimates from the 2005 trawl survey. The unweighted average of the biomass at depths greater than 100m from the three most recent trawl surveys (2001, 2003, and 2005) results in an estimate of exploitable biomass of 37,461 mt. The SSC has determined that reliable estimates of natural mortality exist for shortraker rockfish, thereby qualifying for management under Tier 5. As in the past, the author and the Plan Team recommend setting F_{ABC} at the maximum permissible rate of $0.75 \times M$ for shortraker. The recommended F_{ABC} for shortraker rockfish is 0.023 (i.e., 0.75×0.03), which results in an ABC of 843 mt. An OFL of 1,124 mt for shortraker results from applying an $F_{OFL} = M = 0.03$.

Area apportionment of 2006 and 2007 ABC for shortraker rockfish in the Gulf of Alaska:

Western	Central	Eastern	Total
153	353	337	843

Other Slope rockfish

Status and catch specifications (mt) of the Other Slope rockfish management category and projections for 2006 and 2007. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through 11/05/2005.

Species	Year	Biomass ¹	OFL	ABC	TAC	Catch
Other Slope rockfish	2004	89,460	6,610	3,900	670	872
	2005	89,460	5,150	3,900	670	671
	2006	93,552	5,394	4,152		
	2007	93,552	5,394	4,152		

¹Exploitable biomass based on trawl surveys.

The assessment of the Other Slope rockfish complex is updated with biomass estimates from the 2005 trawl survey. The unweighted average of the biomass at depths greater than 100m from the three most recent trawl surveys (2001, 2003, and 2005) results in an estimate of exploitable biomass of 93,552 mt. The SSC has determined that reliable estimates of natural mortality exist for the Other Slope rockfish, thereby qualifying for management under Tier 5. As in the past, the Plan Team recommends setting F_{ABC} at the maximum permissible rate of $0.75 \times M$ for “other” slope rockfish, excluding sharpchin. Applying the definitions for ABC and OFL places sharpchin rockfish in Tier 4 that allows for a maximum permissible $F_{ABC} = F_{40\%}$. This results in an F_{ABC} of 0.053 for sharpchin rockfish.

For “other” slope rockfish, applying the combination of F rates results in an ABC of 4,152 mt and an OFL of 5,394 mt. Last November the Plan Team noted that ABC for other slope rockfish in the Western and in Central areas was exceeded by 600% in the WGOA and 176% in the CGOA in 2004. The ABC’s were exceeded again in 2005 by 231% and 188% respectively. The Team discussed whether there was a reason for concern, noting that the biomass of these rockfish are likely underestimated because their

preferred habitat is believed to be in rough bottom areas inaccessible to the trawl survey. However, the Team noted an additional reason for concern was that the catch of these species may be under reported when taken in other rockfish fisheries. The Team suggested that the assessment author endeavor to determine the possibility that Other Slope rockfish are being overfished in this area.

Area apportionment of 2006 and 2007 ABC for Other Slope rockfish in the Gulf of Alaska:

	Western	Central	WYAK	SEO	Total
ABC	577	386	317	2,872	4,152

12. Pelagic shelf rockfish

Status and catch specifications (mt) of pelagic shelf rockfish and projections for 2006 and 2007. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. ABC and OFL for 2007 are projected assuming 2006 catch equals 2,649 mt for dusky rockfish. Catch data are current through 11/05/2005.

Area	Year	Biomass ¹	OFL	ABC	TAC	Catch
GOA	2004	57,412	5,570	4,470	4,470	2,645
	2005	65,559	5,680	4,553	4,553	2,183
	2006	97,368	6,662	5,436		
	2007		6,779	5,530		

Pelagic shelf rockfish are made up of dusky rockfish (~83%) plus three other species (dark, yellowtail, and widow rockfish). In 2003 the age-structured model for dusky rockfish was first accepted as an alternative to average trawl survey biomass estimates and was used to determine ABC. For dark, widow, and yellowtail rockfish the Plan Team continues to recommend using the average of exploitable biomass from the three most recent trawl surveys to determine ABC. The ABC's for each of these species is used for this assemblage.

For this year's assessment, additional data for the dusky rockfish model included 2005 survey biomass estimates, 2004 fishery ages, 2005 fishery lengths, updated 2004 catch, and estimated 2005 catch. The 2005 survey biomass estimate for dusky rockfish was 170,484 mt which was a 2.5 fold increase over the 2003 estimate. The authors provided results from two separate models. Model 1, the base model, was presented in 2004 and was updated with new data. Model 2 incorporated several changes including a change in natural mortality (M), an updated size-age matrix, and several parameter penalties were relaxed in response to having more data. The Plan Team agreed with the authors that Model 2 best represented the available data. Natural mortality (M) was changed from 0.09 to 0.07 because new age data has become available since this was first estimated in 1991 and a recent study estimated an M of 0.07 for dark rockfish. Predicted survey biomass estimates followed the observed biomass trend well in Model 2 when compared to Model 1. Recruitment continues to be highly variable and several recent year classes appear strong in 2003 survey ages (1995, 1997, 1998). Projected 2006 female spawning biomass for dusky rockfish is 24,733 mt compared to the estimate of $B_{40\%}$ of 18,291 mt; therefore, dusky rockfish are in Tier 3a. The maximum permissible F_{ABC} is $F_{40\%} = 0.088$ which is associated with a yield of 4,885 mt and is the Plan Team's recommendation for the 2006 dusky rockfish ABC. The OFL ($F_{35\%} = 0.108$) is 5,927 mt. Based on model projections and estimated catches for dusky rockfish, the 2007 ABC is 4,979 mt and OFL is 6,044 mt.

For dark, widow, and yellowtail rockfishes the Plan Team agreed with the author's recommendation to use the average of exploitable biomass from the three most recent trawl surveys (2001, 2003, 2005) to determine ABC's. The averaging technique was used because of the uncertainty of the biomass estimates and the desire to avoid placing too much emphasis on the results of an individual survey. The Plan Team also agreed with the author's decision to apply a natural mortality M of 0.07 for these species rather than

the previous M of 0.09. This results in exploitable biomass estimates of 8,301 mt for dark rockfish, 168 mt for widow rockfish, and 2,024 mt for yellowtail rockfish. The 2006 recommended ABC for dark, widow, and yellowtail rockfish is 551 mt based on tier 5 calculations $F_{ABC}=0.0525$ ($F=0.75*M$). The OFL ($F=M=0.07$) for dark, widow, and yellowtail rockfish is 735 mt. These species are managed as Tier 5 since there are no reliable estimates of $F_{40\%}$ and $F_{35\%}$. The 2007 recommended ABC and OFL for these will be rolled over from 2006 estimates because no new survey data will be available.

Combining the dusky rockfish model estimates with dark, widow, and yellowtail rockfish estimates results in a recommended ABC of 5,436 mt for pelagic shelf rockfish and an OFL of 6,662 mt. The 2007 recommended ABC for pelagic shelf rockfish is 5,530 mt and OFL is 6,779 mt.

Apportionment of pelagic shelf rockfish is based on weighting of the NMFS trawl surveys at 4:6:9 for 2001, 2003, and 2005. Based on this weighting scheme, the percent distribution of pelagic shelf rockfish is 26% in Western, 60% in Central, and 14% in Eastern. The Eastern area is further apportioned based on the point estimate of the weighted average of the estimates of the eastern Gulf biomass proportion that is in West Yakutat (0.22). The total ABC apportionments for the pelagic shelf rockfish complex in 2006 are: Western area, 1,438 mt; Central area, 3,262 mt; West Yakutat, 301 mt, and East Yakutat/Southeast Outside, 435 mt.

Area apportionments of ABC for pelagic shelf in 2006					
	Western	Central	W. Yakutat	E. Yakutat/SE	Total
2006	1,438	3,262	301	435	5,436
2007	1,463	3,318	306	443	5,530

13. Demersal shelf rockfish

Status and catch specifications (mt) of demersal shelf rockfish and projections for 2005 and 2006. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through 11/05/05.

Area	Year	Biomass	OFL	ABC	TAC	Catch*
SEO GOA	2004	20,168	690	450	450	260
	2005	18,508	640	410	410	289
	2006	19,558	650	410		
	2007		650	410		

*Note catch data as reported by NMFS catch accounting. This catch may differ from that reported in the assessment.

This year's demersal shelf rockfish chapter features new data from the 2005 line transect survey for the SSEO management area, new average weight data from SEO, and includes age data from the 2003 and 2004 commercial fishery. DSR species composition data from commercial fishery data was reviewed and consequently the adjustment for non-yelloweye species in the ABC and OFL calculations decreased from 11% to 4.2%. There is a new section included on estimated mortality of DSR in the sport fish fishery.

Density and biomass is based on yelloweye rockfish only. New density surveys were conducted during 2005 in SSEO. Yelloweye rockfish density for this stock assessment is based on the last best estimate by management area. The EYKT and CSEO areas were last surveyed in 2003 and NSEO was surveyed in 2001. Density estimates by area range from 1,420 to 3,557 adult yelloweye per km^2 . The density estimate for SSEO in 2005 was 2,196 adult yelloweye/ km^2 ($\text{CV}=17.16\%$). This is higher than the previous estimate obtained in 1999 of 1,879 adult yelloweye/ km^2 ($\text{CV}=17.11\%$), however the difference is not significant.

The SSC determined that reliable estimates of B_{MSY} are not available for this stock. There are reliable point estimates of B , $F_{35\%}$, and $F_{40\%}$ therefore the species is managed under Tier 4. Biomass is estimated using the lower 90% confidence limit of the point estimate by management area. Maximum allowable ABC under Tier 4 is based on $F_{40\%}$. Demersal shelf rockfish are particularly vulnerable to overfishing given their longevity, late maturation, and sedentary and habitat-specific residency. The Plan Team concurred with the authors' recommendation to establish a harvest rate lower than the maximum allowed under Tier

4. By applying $F=M=0.02$ to this biomass and adjusting for other DSR species, the recommended 2006 ABC is 410 mt. This rate is more conservative than would be obtained by using Tier 4 definitions for setting ABC, as $F_{40\%}=0.026$.

The OFL fishing mortality rate under Tier 4 is $F_{35\%}=0.032$. Adjusting for the DSR species other than yelloweye, the overfishing level for 2006 is 650 mt.

14. *Thornyheads*

Status and catch specifications (mt) of thornyheads and projections for 2006 and 2007. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. 2005 Catch data are current through 11/05/2005.

Area	Year	Biomass	OFL	ABC	TAC	Catch
GOA	2004	86,200	2,590	1,940	1,940	818
	2005	86,200	2,590	1,940	1,940	711
	2006	98,158	2,945	2,209		
	2007		2,945	2,209		

While thornyhead rockfish are a commercially valuable species, there is no directed fishery because they are taken as incidental catch in other directed groundfish fisheries. Thornyheads are incidentally caught in directed fisheries for rockfish, flatfish and sablefish. Catch in recent years has been declining. The complex is dominated by shortspine thornyheads with longspine thornyheads making up a very minor component of the complex. Broadfin thornyheads (*S. macrochir*) are rarely if ever encountered and it is recommended that these be removed from the assemblage.

Since 2003, thornyhead rockfish have been assessed using Tier 5 criteria given the lack of age data available to support age structured modeling. The average of the two most recent GOA trawl survey biomass estimates (2003 and 2005) was used to estimate exploitable biomass of 98,158 mt. Under Tier 5, $F_{OFL} = M = 0.03$, and maximum permissible $F_{ABC} = 0.75 \times M = 0.0225$. The 2006 (and 2007) ABC was determined by multiplying the exploitable biomass by max $F_{ABC}=0.0225$ giving 2,209 mt. The corresponding OFL is 2,945 mt.

Area apportionments for thornyhead ABC's in 2006 (and 2007) are based upon the relative distribution of biomass by area from the 2005 survey.

Western	Central	Eastern	Total
513	989	707	2,209

15. *Atka mackerel*

Status and catch specifications (mt) of Atka mackerel and projections for 2006 and 2007. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through 11/05/2005.

Area	Year	Biomass	OFL	ABC	TAC	Catch
GOA wide	2004		6,200	600	600	819
	2005		6,200	600	600	882
	2006		6,200	4,700		
	2007		6,200	4,700		

Gulf of Alaska Atka mackerel are in Tier 6; a reliable estimate of biomass is not available and an assessment model for GOA Atka mackerel has not been developed. Age data from the 2003 and 2004 fisheries are presented, and biomass estimates from the 2003 and 2005 surveys are presented for the first time for Tier 5 consideration. Observations of Atka mackerel in the 2003-2005 fisheries and in both the

2003 and 2005 GOA trawl surveys extended well into the GOA. Age data from the 2003 and 2004 fisheries and the 2003 GOA survey were primarily comprised of fish from the 1999 year class, which has been documented as very strong year class in the Aleutian Islands Atka mackerel assessment. Gulfwide Atka mackerel catches exceeded the TAC of 600 mt in both 2004 and 2005.

The Plan Team reviewed the biomass estimates from the 2005 survey for Tier 5 consideration. However, the Plan Team agreed with the assessment author that biomass estimates are highly variable (2005 survey CV=50%), and continued to recommend Tier 6 for ABC and OFL estimates at this time. Under Tier 6, maximum permissible ABC is 4,700 mt and OFL is 6,200 mt. The Plan Team has historically supported measures to prevent directed fishing for Atka mackerel in the GOA. A conservative harvest policy for Atka mackerel has been recommended because: (1) there are no reliable biomass estimates; (2) localized depletion may occur and they are an important component of Steller sea lion diet; (3) this species appears to be particularly vulnerable to fishing pressure because of its very patchy distribution and sporadic recruitment patterns in the GOA; and (4) although increased numbers of Atka mackerel are appearing in the GOA, they are comprised primarily of a single cohort (the 1999 year class).

The Plan Team discussed the recent high catches in 2003-2005 fisheries and the observations in the 2003 and 2005 GOA surveys. However both the survey and fishery are dominated by a single (1999) year class and there appears to be no evidence of a broad distribution of year classes in the data. Prudent management of this stock still seems warranted in order to avoid the historical patterns of exploitation and subsequent population depletion.

The Plan Team recognizes that additional data for this stock is necessary and would encourage the development of an experimental fishing permit for limited targeting of Atka mackerel in the western GOA for purposes of increased data collection.

The Plan Team recommends the maximum permissible ABC of 4,700 mt, but strongly encourages a TAC of 1,500 mt for this stock. The TAC recommendation is intended only to meet the anticipated increased incidental catch needs in other fisheries. Constraining the TAC to this level would provide the opportunity for an experimental fishery without danger of exceeding the ABC.

16. *Skates*

Summary of OFLs and ABC for 2006 and 2007. Biomass estimates are averages from the 1999-2005 NMFS GOA bottom trawl surveys.								
Species group	Area	Average Biomass	2005				2006 and 2007	
			OFL	ABC	TAC	Catch	ABC	OFL
Big skate	W	9,273		727	727	26	695	
	C	30,005		2,463	2,463	758	2,250	
	E	7,982		809	809	60	599	
	Total	47,260	5,332	3,999	3,999	844	3,544	4,726
Longnose skate	W	868		66	66	15	65	
	C	26,255		1,972	1,972	947	1,969	
	E	11,478		780	780	135	861	
	Total	38,601	3,757	2,818	2,818	1,097	2,895	3,860
Bathyrāja skates	GOA wide	21,564	1,769	1,327	1,327	663	1,617	2,156

NOTE: Catches are based on official statistics whereas those reported in the assessment have been adjusted based on port sampling analysis.

Total catch weight for GOA skates has been updated with 2004 and partial 2005 data. Biomass estimates from the 2005 GOA bottom trawl survey have been incorporated. Life history information has been updated with preliminary recent research results. Information on the position of skates within the GOA ecosystem and the potential ecosystem effects of skate removals are included in the assessment. The survey data indicate level trends in most species except for some indication of a declining biomass of big skates since 2003.

Estimated catches of skates this year were slightly higher in tonnage than 2004, but were not at the levels of years prior to that. Species composition in the catch was similar in composition to previous years. Female big skates were dominant in 2005 sampled landings. Sampling and data quality for management remain substandard, with considerable misidentification on ADF&G fish tickets.

A major change in the data this year was a correction in the estimated bycatch of skates in the halibut fishery, which exceeds the catch of skates in the groundfish fishery. The Plan Team discussed the importance of gaining information on skate catches from the Halibut fishery. The estimates of skate bycatch from the halibut fishery alone could put longnose skates over the Gulfwide OFL; both the author and Plan Team noted that better estimates of skate bycatch in halibut fisheries are necessary.

There is also a concern about the reporting of skate bycatch in the IPHC Halibut survey in that skate numbers are extrapolated from the sampling of only the first 20 hooks. Another major problem is that the amount of port sampling coverage is decreasing. It was noted that the Plan Team may wish to suggest to the IPHC that their means of collecting bycatch information on their survey is not useable for other fisheries, and that the halibut fishery greatly impacts many groundfish fisheries.

Given the continued lack of halibut and groundfish fishery observation, the Plan Team agreed with the author's recommendation that no target fishery be permitted for skates. Directed fishing was not recommended because basic stock assessment information remains inadequate and estimated incidental catch in groundfish and halibut fisheries currently is likely to exceed the proposed ABCs for big, longnose, and other skates in the GOA. Biological studies are ongoing but fishery sampling remains problematic.

The Plan Team concurred with author recommendations for area specific (Western, Central, and Eastern) ABCs for both big and longnose skates. The author recommended area specific OFLs for these species but the Plan Team felt that demonstrable evidence for stock structure and localized depletion that would be detrimental to sub-populations was missing and that the other measures (e.g., no directed fishery, ABC apportioned by area) provide adequate protection at this time.

Therefore, the Plan Team recommends summing the area-specific OFLs for each species provided by the author into Gulfwide OFLs for big and longnose skates. The Plan Team concurred with the author recommendation to maintain Gulfwide ABC's and OFL's for the genus *Bathyraja* skate complex in the GOA.

The OFL fishing mortality rate under Tier 5 is set equal to the estimate of M , so $F_{OFL}=0.10$ for both big and longnose skates and for the *Bathyraja* genus complex.

Other Species

The other species complex in the GOA contains the following species: squids, sculpins, sharks and octopi. There is no annual assessment for these species in the GOA, and ABCs and OFLs are not specified. The complex level TAC is calculated as equal to 5% of the sum of the target species TACs for the GOA. As currently configured, the "other species" complex is open to directed fishing up to the TAC specified for the complex after subtracting the amount of "other species" needed as incidental catch in other groundfish fisheries. This has caused conservation concerns given the removal of several species over time from the complex, which under the current calculation has served to increase the complex TAC by placing additional species into target categories upon which the TAC for the complex is based. Additionally, given the configuration of the complex, it is possible to target one member of the complex close to the full complex-level TAC, which inhibits in-season management's ability to control directed fishing within the complex and raises concerns given the lack of available stock information on most members of the complex.

As an interim measure, the Council took final action in June 2005 to implement a calculation change to this TAC under amendment 69 to the GOA FMP. The 5% TAC calculation was modified such that the Council may recommend a TAC at or below 5% of the sum of the target species TACs during the annual specifications process. The Council's intent was to establish a TAC level which would meet incidental

catch needs in other directed fisheries with the potential to establish this TAC at a higher level which could allow for directed fishing on the complex but be placed low enough to prevent excessive harvest of a single targeted species or on the complex as a whole. This interim measure is intended to provide additional flexibility in responding to potential conservation concerns as they arise until more comprehensive management changes can be made to the other species complex (i.e., analysis of individual species level assessments).

In order to provide the Council information to establish a TAC for the other species complex, the Plan Team discussed the incidental catch needs for directed fisheries. Using information provided in the EA/RIR/IRFA for amendment 69, the Plan Team reviewed the recent catch of other species in directed fisheries. In 2004, the other species catch (in directed groundfish fisheries) was 1,638 mt, representing 1.0% of the total catch. Catch so far in 2005 (through November 5th) is 2,232 mt. Note these catches are aggregate for the complex and catches on individual members within the complex are not available at this time. The Plan Team discussed anecdotal reports of increased amounts of spiny dogfish discards in the commercial halibut fishery this year which could represent a significant (and unreported) additional catch. The Team also noted continued problems with estimating incidental catch of “other species” from the halibut fishery, which may constitute a significant portion of the total catch of “other species” in the GOA.

Exploratory fishing is often on-going for species contained within the complex depending upon market conditions. There is a limited market for sharks currently with the potential for a larger market to develop. A limited fishery for octopus began in 2004 with small amounts of directed catch landed. Multiple markets for several ports exist in the GOA for octopus with anecdotal reports of increased interest in this species. A fishery for octopus is developing in the Bering Sea and there is evidence of increased retention of octopus in both the Bering Sea and GOA.

The Plan Team continues to be concerned about the ability for directed fishing on a single species within the other species complex up to the complex-level TAC. The Plan Team strongly encourages a TAC be established which would meet incidental catch needs (so as not to constrain directed fisheries) while providing in-season management the ability to control rapid development of directed fishing on a single member of the complex. After reviewing incidental catch needs in directed fisheries together with discussion of the potential for developing fisheries on members of the other species complex, the Plan Team believes that a TAC of 4000 mt for the complex would meet incidental catch needs and allow for exploratory fishing under the existing MRAs. Any amount set above this level would allow for additional directed fishing on the complex, and the Plan Team reiterates their concerns about the unknown impact this may impose on single species within the larger complex.

Overview of Appendices

Forage fish

An updated assessment of forage fish species in the Gulf of Alaska is provided in **Appendix A**, which includes all available new information since the first GOA forage fish assessment presented in 2003. A directed fishery for forage fish is prohibited and other limitations are placed on the bycatch, sale, barter, trade, or processing of any species in this group by amendment 39 to the GOA Groundfish FMP. The purpose of this assessment was to compile the available data for forage fish species in the GOA and to assess future assessment needs. No specific surveys are conducted for sampling forage fish species, thus data collection is notably problematic for these species. However, available surveys and catch data do provide some information for assessing the status of these species. Increases in capelin and eulachon were seen in 2003 in comparison to calculated biomass estimates from previous years. Estimated exploitation rates for capelin and eulachon based on available surveys were found to be 1% or less, which is considered minimal.

The Plan Team commended the authors for the continued emphasis on forage fish. Forage fish are essential ecosystem components, important to marine mammals and commercially important groundfish.

The Plan Team would like to maintain the Forage Fish chapter as an intermittent SAFE appendix to be updated as new information becomes available.

Acronyms

A collection of acronym definitions used in the SAFE has been included as **Appendix B**.

Table 1. Gulf of Alaska groundfish 2005 - 2007 OFLs and ABCs, 2005 TACs, and 2005 catches reported through November 5, 2005.

Stock/Assemblage	2005					2006		2007	
	Area	OFL	ABC	TAC	Catch	OFL	ABC	OFL	ABC
Pollock	W (61)		30,380	30,380	31,116		29,187		23,291
	C (62)		34,404	34,404	27,838		30,775		24,558
	C (63)		18,718	18,718	19,348		18,619		14,858
	WYAK		1,688	1,688	1,879		1,809		1,443
	Subtotal	144,340	85,190	85,190	80,181	110,100	80,390	89,500	64,150
	EYAK/SEO	8,690	6,520	6,520	0	8,209	6,157	8,209	6,157
	Total	153,030	91,710	91,710	80,181	118,309	86,547	97,709	70,307
Pacific Cod	W		20,916	15,687	12,208		31,051		19,292
	C		33,117	25,086	21,241		43,790		27,206
	E		4,067	3,660	14		4,777		2,968
	Total	86,200	58,100	44,433	33,462	95,500	79,618	59,100	49,466
Sablefish	W		2,540	2,540	1,892		2,670		2,360
	C		7,250	7,250	6,602		6,370		5,630
	WYAK		2,580	2,580	1,825		2,280		2,014
	SEO		3,570	3,570	3,335		3,520		3,116
	Total	19,280	15,940	15,940	13,654	17,880	14,840	15,800	13,120
Deep-water flatfish ¹	W		330	330	3		420		421
	C		3,340	3,340	395		4,139		4,145
	WYAK		2,120	2,120	4		2,661		2,665
	EYAK/SEO		1,030	1,030	4		1,445		1,446
	Total	8,490	6,820	6,820	406	11,008	8,665	11,022	8,677
Rex sole	W		1,680	1,680	576		1,159		1,096
	C		7,340	7,340	1,576		5,506		5,207
	WYAK		1,340	1,340	0		1,049		992
	EYAK/SEO		2,290	2,290	0		1,486		1,405
	Total	16,480	12,650	12,650	2,152	12,000	9,200	11,400	8,700
Shallow-water flatfish ²	W		21,580	4,500	108		24,720		24,720
	C		27,250	13,000	4,516		24,258		24,258
	WYAK		2,030	2,030	0		628		628
	EYAK/SEO		1,210	1,210	6		1,844		1,844
	Total	63,840	52,070	20,740	4,630	62,418	51,450	62,418	51,450
Flathead sole	W		11,690	2,000	611		10,548		10,932
	C		30,020	5,000	1,904		25,195		26,111
	WYAK		3,000	3,000	0		2,022		2,096
	EYAK/SEO		390	390	0		55		57
	Total	56,500	45,100	10,390	2,515	47,003	37,820	48,763	39,196
Arrowtooth flounder	W		26,250	8,000	2,531		20,154		21,011
	C		168,950	25,000	16,681		134,906		140,640
	WYAK		11,790	2,500	23		15,954		16,632
	EYAK/SEO		9,910	2,500	29		6,830		7,120
	Total	253,900	216,900	38,000	19,264	207,678	177,844	216,500	185,403

Table 1. continued.

Stock/Assemblage	2005					2006		2007	
	Area	OFL	ABC	TAC	Catch	OFL	ABC	OFL	ABC
Other slope ³	W		40	40	93		577		577
	C		300	300	565		386		386
	WYAK		130	130	70		317		317
	EYAK/SEO		3,430	200	36		2,872		2,872
	Total	5,150	3,900	670	764	5,394	4,152	5,394	4,152
Northern rockfish ³	W		808	808	570		1,483		1,483
	C		4,283	4,283	4,208		3,608		3,608
	E		0	0	0		0		0
	Total	6,050	5,091	5,091	4,778	7,673	5,091	7,618	5,091
Pacific ocean perch	W	3,076	2,567	2,567	2,340	4,931	4,155	4,997	4,290
	C	10,226	8,535	8,535	8,145	8,806	7,418	8,923	7,660
	WYAK		841	841	872		1,101		1,137
	SEO		1,632	1,632	0		1,587		1,639
	E(subtotal)	2,964				3,190	2,688	3,232	2,776
	Total	16,266	13,575	13,575	11,357	16,927	14,261	17,152	14,726
Shortraker	W		155	155	70		153		153
	C		324	324	224		353		353
	E		274	274	203		337		337
	Total	982	753	753	497	1,124	843	1,124	843
Rougheyeye	W		188	188	52		136		133
	C		557	557	122		608		596
	E		262	262	122		239		235
	Total	1,531	1,007	1,007	296	1,180	983	1,161	964
Pelagic shelf rockfish	W		377	377	120		1,438		1,463
	C		3,067	3,067	1,845		3,262		3,318
	WYAK		211	211	215		301		306
	EYAK/SEO		898	898	3		435		443
	Total	5,680	4,553	4,553	2,183	6,662	5,436	6,779	5,530
Demersal rockfish	SEO	640	410	410	289	650	410	650	410
Thornyhead rockfish	W		410	410	189		513		513
	C		1,010	1,010	388		989		989
	E		520	520	134		707		707
	Total	2,590	1,940	1,940	711	2,945	2,209	2,945	2,209
Atka mackerel	Total	6,200	600	600	882	6,200	4,700	6,200	4,700
Big skate	W		727	727	26		695		695
	C		2,463	2,463	758		2,250		2,250
	E		809	809	60		599		599
	Total	5,332	3,999	3,999	844	4,726	3,544	4,726	3,544
Longnose skate	W		66	66	15		65		65
	C		1,972	1,972	947		1,969		1,969
	E		780	780	135		861		861
	Total	3,757	2,818	2,818	1,097	3,860	2,895	3,860	2,895
Other skates	Total	1,769	1,327	1,327	663	2,156	1,617	2,156	1,617
Other Species	Total	NA	NA	13,871	2232	NA	NA		NA
Total		713,667	539,263	291,298	182,957	631,293	512,125	582,477	473,000

¹ "Deep water flatfish" includes Dover sole, Greenland turbot and deepsea sole.² "Shallow water flatfish" includes rock sole, yellowfin sole, butter sole, starry flounder, English sole, Alaska plaice, and sand sole.³ The EGOA ABC of 2 mt for northern rockfish has been included in the WYAK ABC for other slope rockfish.

Table 2. Gulf of Alaska 2006 ABCs, biomass, and overfishing levels (mt) for Western, Central, Eastern, Gulfwide, West Yakutat, and Southeast Outside regulatory areas.

Species/Assemblage	2006			
	Area	ABC	Biomass	Overfishing Level
Pollock	W (61)	29,187		
	C (62)	30,775		
	C (63)	18,619		
	WYAK	1,809		
	Subtotal	80,390	608,370	110,100
	EYAK/SEO	6,157	27,362	8,209
	Total	86,547	635,732	118,309
Pacific Cod	W	31,051		
	C	43,790		
	E	4,777		
	Total	79,618	453,000	95,500
Sablefish	W	2,670		
	C	6,370		
	WYAK	2,280		
	EY/SEO	3,520		
	Total	14,840	152,000	17,880
Deep water flatfish	W	420		
	C	4,139		
	WYAK	2,661		
	EYAK/SEO	1,445		
	Total	8,665	132,297 ⁴	11,008
Rex sole	W	1,159		
	C	5,506		
	WYAK	1,049		
	EYAK/SEO	1,486		
	Total	9,200	83,600 ⁵	12,000
Shallow water flatfish	W	24,720		
	C	24,258		
	WYAK	628		
	EYAK/SEO	1,844		
	Total	51,450	365,766 ⁵	62,418
Flathead sole	W	10,548		
	C	25,195		
	WYAK	2,022		
	EYAK/SEO	55		
	Total	37,820	291,441 ⁵	47,003
Arrowtooth flounder	W	20,154		
	C	134,906		
	WYAK	15,954		
	EYAK/SEO	6,830		
	Total	177,844	2,140,170 ⁵	207,678

Table 2. continued.

Species/Assemblage	2006			Overfishing Level
	Area	ABC	Biomass	
Other Slope rockfish	W	577		
	C	386		
	WYAK	317 ¹		
	EYAK/SEO	2,872		
	Total	4,152	93,552 ⁵	5,394
Northern rockfish	W	1,483		
	C	3,608		
	E	0 ¹		
	Total	5,091	136,311	7,673
Pacific ocean perch	W	4,155		4,931
	C	7,418		8,806
	WYAK	1,101		
	EY/SEO	1,587		
	EGOA			3,190
	Total	14,261	312,968	16,927
Shortraker	W	153		
	C	353		
	E	337		
	Total	843	37,461	1,124
Rougheye	W	136		
	C	608		
	E	239		
	Total	983	37,449	1,180
Pelagic shelf rockfish	W	1,438		
	C	3,262		
	WYAK	301		
	EY/SEO	435		
	Total	5,436	97,368	6,662
Demersal shelf rockfish	Total	410	19,558	650
Thornyhead rockfish	Western	513		
	Central	989		
	Eastern	707		
	Total	2,209	98,158 ⁵	2,945
Atka mackerel	Total	4,700	Unknown	6,200
Big skates	W	695	9,273	
	C	2,250	30,005	
	E	599	7,982	
	Total	3,544	47,260	4,726
Longnose skates	W	65	868	
	C	1,969	26,255	
	E	861	11,478	
	Total	2,895	38,601	3,860
Other skates	Total	1,617	21,564	2,156
Other species	NA			TAC = 5% of GF TACS
All species	Total	512,125	5,829,988	631,293

1/ The EGOA ABC of 2 mt for northern rockfish has been included in the WYAK ABC for other slope rockfish.

2/ Abundance relative to target stock size as specified in SAFE documents.

3/ Historically lightly exploited therefore expected to be above the specified reference point.

4/ Biomass of Dover sole; biomass of Greenland turbot and deep-sea sole is unknown.

NOTE: Overfishing is defined Gulf-wide, except for pollock and POP.

Table 3. Summary of fishing mortality rates and overfishing levels for the Gulf of Alaska, 2005.

Species	Tier	F _{ABC} ¹	Strategy	F _{OFL} ²	Strategy
Pollock	3b	0.20	F _{ABC}	0.27	F _{35%} adjusted
Pacific cod	3a	0.545	F _{40%}	0.677	F _{35%}
Sablefish	3b	0.105	F _{40%} adjusted	0.128	F _{35%} adjusted
Deepwater flatfish	3a, 6 ³	0.142	F _{40%} , F _{ABC} ³	0.184	F _{35%} , F _{OFL} ⁴
Rex sole	5	0.1275	F=.75M	0.17	F=M
Flathead sole	3a	0.359	F _{40%}	0.463	F _{35%}
Shallow water flatfish	4,5 ⁵	0.162-0.204	F _{40%} , F=.75M ⁵	0.192-0.245	F _{35%} , F=M ⁶
Arrowtooth	3a	0.142	F _{40%}	0.168	F _{35%}
Pacific ocean perch	3a	0.062	F _{40%}	0.074	F _{35%}
Rougheye rockfish	3a	0.039	F _{40%}	0.047	F _{35%}
Shortraker rockfish	5	0.023	F=.75M	0.03	F=M
Other slope rockfish	4, 5 ⁷	0.053, 0.03-0.075	F _{40%} , F=.75M ⁷	0.064, 0.04-0.10	F _{35%} , F=M ⁸
Northern rockfish	3a	0.053	F _{ABC}	0.080	F _{35%}
Pelagic Shelf Rockfish	3a, 5 ⁹	0.088, 0.0525	F _{40%} , F=.75M ⁹	0.108, 0.07	F _{35%} , F=M ¹⁰
Demersal Shelf Rockfish	4	0.02	F=M	0.032	F _{35%}
Thornyhead rockfish	5	0.0225	F=.75M	0.03	F=M
Atka mackerel	6	NA	F _{ABC} ¹¹	NA	F _{OFL} ¹²
Skates	5	0.075	F=.75M	0.10	F=M

- 1/ Fishing mortality rate corresponding to acceptable biological catch.
- 2/ Maximum fishing mortality rate allowable under overfishing definition.
- 3/ F_{40%}= for Dover sole (Tier 3a), ABC=.75 x average catch (1978-1995) for other deepwater flatfish (Tier 6).
- 4/ F_{35%} for Dover sole (Tier 3a), average catch (1978-1995) for other deepwater flatfish (Tier 6).
- 5/ F_{40%} for northern and southern rocksole (Tier 4), F=.75M for remaining shallow water flatfish (Tier 5).
- 6/ F_{35%} for northern and southern rocksole (Tier 4), F=M for remaining shallow water flatfish (Tier 5).
- 7/ F_{40%} for sharpchin rockfish (Tier 4), F=.75M for other species (Tier 5).
- 8/ F_{35%} for sharpchin (Tier 4), F=M for other species (Tier 5).
- 9/ F_{40%} for dusky rockfish (Tier 3a), F=.75M for widow and yellowtail rockfish (Tier 5).
- 10/ F_{35%} for dusky rockfish (Tier 3a), F=M for widow and yellowtail rockfish (Tier 5).
- 11/ ABC for Atka mackerel is equal to 0.75 x average catch from 1978 to 1995. This maximum permissible ABC is intended for bycatch in other target fisheries and the opportunity for a possible future experimental fishing permit.
- 12/ OFL for Atka mackerel is equal to average catch from 1978 to 1995.

Table 4. Maximum permissible fishing mortality rates and ABCs as defined in Amendment 56 to the GOA and BSAI Groundfish FMPs, and the Plan Team's 2006 recommended fishing mortality rates and ABCs, for those species whose recommendations were below the maximum. Relative to last year, Pacific cod, roughey rockfish, and sharpchin rockfish were removed from this table since the Plan Team (and the authors, except for Pacific cod) recommended the maximum permissible F_{ABC} values.

Species	Tier	2006			2006
		$Max F_{ABC}$	$Max ABC$	F_{ABC}	ABC
Pollock	3b	0.23	95,200	0.20	81,300
Northern Rockfish	3a	0.066	6,400	0.053	5,100
Demersal shelf rockfish	4	0.026	530	0.02	410

1/ The Plan Team recommended 2006 W/C pollock ABC of 80,390 mt is reduced by 910 mt to accommodate the Prince William Sound GHL. For comparisons in this table, the maximum permissible ABC of 95,200 mt should be compared with the full ABC of 81,300 mt.

Table 5. Groundfish landings (metric tons) in the Gulf of Alaska, 1956-2005.

Year	Pollock	Pacific Cod	Sable Fish	Flat Fish	Arrowtooth Flounder	Slope Rock Fish ^a
1956			1,391			
1957			2,759			
1958			797			
1959			1,101			
1960			2,142			
1961			897			16,000
1962			731			65,000
1963			2,809			136,300
1964	1,126	196	2,457	1,028		243,385
1965	2,749	599	3,458	4,727		348,598
1966	8,932	1,376	5,178	4,937		200,749
1967	6,276	2,225	6,143	4,552		120,010
1968	6,164	1,046	15,049	3,393		100,170
1969	17,553	1,335	19,376	2,630		72,439
1970	9,343	1,805	25,145	3,772		44,918
1971	9,458	523	25,630	2,370		77,777
1972	34,081	3,513	37,502	8,954		74,718
1973	36,836	5,963	28,693	20,013		52,973
1974	61,880	5,182	28,335	9,766		47,980
1975	59,512	6,745	26,095	5,532		44,131
1976	86,527	6,764	27,733	6,089		46,968
1977	112,089	2,267	17,140	16,722		23,453
1978	90,822	12,190	8,866	15,198		8,176
1979	98,508	14,904	10,350	13,928		9,921
1980	110,100	35,345	8,543	15,846		12,471
1981	139,168	36,131	9,917	14,864		12,184
1982	168,693	29,465	8,556	9,278		7,991
1983	215,567	36,540	9,002	12,662		7,405
1984	307,400	23,896	10,230	6,914		4,452
1985	284,823	14,428	12,479	3,078		1,087
1986	93,567	25,012	21,614	2,551		2,981
1987	69,536	32,939	26,325	9,925		4,981
1988	65,625	33,802	29,903	10,275		13,779
1989	78,220	43,293	29,842	11,111		19,002
1990	90,490	72,517	25,701	15,411		21,114
1991	107,500	76,997	19,580	20,068		13,994
1992	93,904	80,100	20,451	28,009		16,910
1993	108,591	55,994	22,671	37,853		14,240
1994	110,891	47,985	21,338	29,958		11,266
1995	73,248	69,053	18,631	32,273		15,023
1996	50,206	67,966	15,826	19,838	22,183	14,288
1997	89,892	68,474	14,129	17,179	16,319	15,304
1998	123,751	62,101	12,758	11,263 ^l	12,974	14,402
1999	95,637	68,613	13,918	8,821	16,209	18,057
2000	71,876	54,492	13,779	13,052	24,252	15,683
2001	70,485	41,614	12,127	11,817	19,964	16,479
2002	49,300 ^j	52,270	12,246	12,520	21,230	17,128
2003	49,300	52,500	14,345	10,750	23,320	18,678
2004	62,826	43,104	15,630	7,634	15,304	18,194
2005 ^H	80,181	33,462	13,654	9,703	19,264	17,792

a/ Catch defined as follows: (1) 1961-78, Pacific ocean perch (*S. alutus*) only; (2) 1979-1987, the 5 species of the Pacific ocean perch complex; 1988-90, the 18 species of the slope rock assemblage; 1991-1995, the 20 species of the slope rockfish assemblage.

b/ Catch from Southeast Outside District.

c/ Thornyheads were included in the other species category, and are foreign catches only.

d/ After numerous changes, the other species category was stabilized in 1981 to include sharks, skates, sculpins, eulachon, capelin (and other smelts in the family Osmeridae and octopus. Atka mackerel and squid were added in 1989. Catch of Atka Mackerel is reported separately for 1990-1992; thereafter Atka mackerel was assigned a separate target species.

Table 5. (cont'd) Groundfish landings (metric tons) in the Gulf of Alaska, 1956-2005.

Year	Pelagic Shelf Rockfish	Demersal Shelf Rockfish ^b	Thorny Heads ^c	Atka Mackerel ^e	Skates ^k	Other Species ^d	Total All Species
1956							1,391
1957							2,759
1958							797
1959							1,101
1960							2,142
1961							16,897
1962							65,731
1963							139,109
1964							248,192
1965							360,131
1966							221,172
1967							139,206
1968							125,822
1969							113,333
1970							84,983
1971							115,758
1972							158,768
1973							144,478
1974							153,143
1975							142,015
1976							174,081
1977			0	19,455		4,642	195,768
1978			0	19,588		5,990	160,830
1979			0	10,949		4,115	162,675
1980			1,351	13,166		5,604	202,426
1981			1,340	18,727		7,145	239,476
1982		120	788	6,760		2,350	234,001
1983		176	730	12,260		2,646	296,988
1984		563	207	1,153		1,844	356,659
1985		489	81	1,848		2,343	320,656
1986		491	862	4		401	147,483
1987		778	1,965	1		253	146,703
1988	1,086	508	2,786	-		647	158,411
1989	1,739	431	3,055	-		1,560	188,253
1990	1,647	360	1,646	1,416		6,289	236,591
1991	2,342	323	2,018	3,258		1,577	247,657
1992	3,440	511	2,020	13,834		2,515	261,694
1993	3,193	558	1,369	5,146		6,867	256,482
1994	2,990 ^f	540	1,320	3,538		2,752	232,578
1995	2,891	219 ^g	1,113	701		3,433	216,585
1996	2,302	401	1,100	1,580		4,302	199,992
1997	2,629	406	1,240	331		5,409	231,312
1998	3,111	552	1,136	317		3,748	246,113
1999	4,826	297	1,282	262		3,858	231,780
2000	3,730	406	1,307	170		5,649	204,396
2001	3,008	301	1,339	76		4,801	182,011
2002	3,318	292	1,125	85		4,040	173,554
2003	2,975	229	1,159	578		6,339	180,173
2004	2,674	260	818	819	2,912	1,559	171,734
2005	2,183	289	711	882	2,604	2,232	182,957

e/ Atka mackerel was added to the Other Species category in 1988 and separated out in 1994

f/ PSR includes light dusky, yellowtail, widow, dark dusky, black, and blue rockfish; after 1998 black and blue were excluded.

g/ Does not include at-sea discards.

h/ Catch data reported through November 5, 2005.

i/ Includes all species except arrowtooth.

j/ Does not include state fisheries

k/ Includes all managed skates species

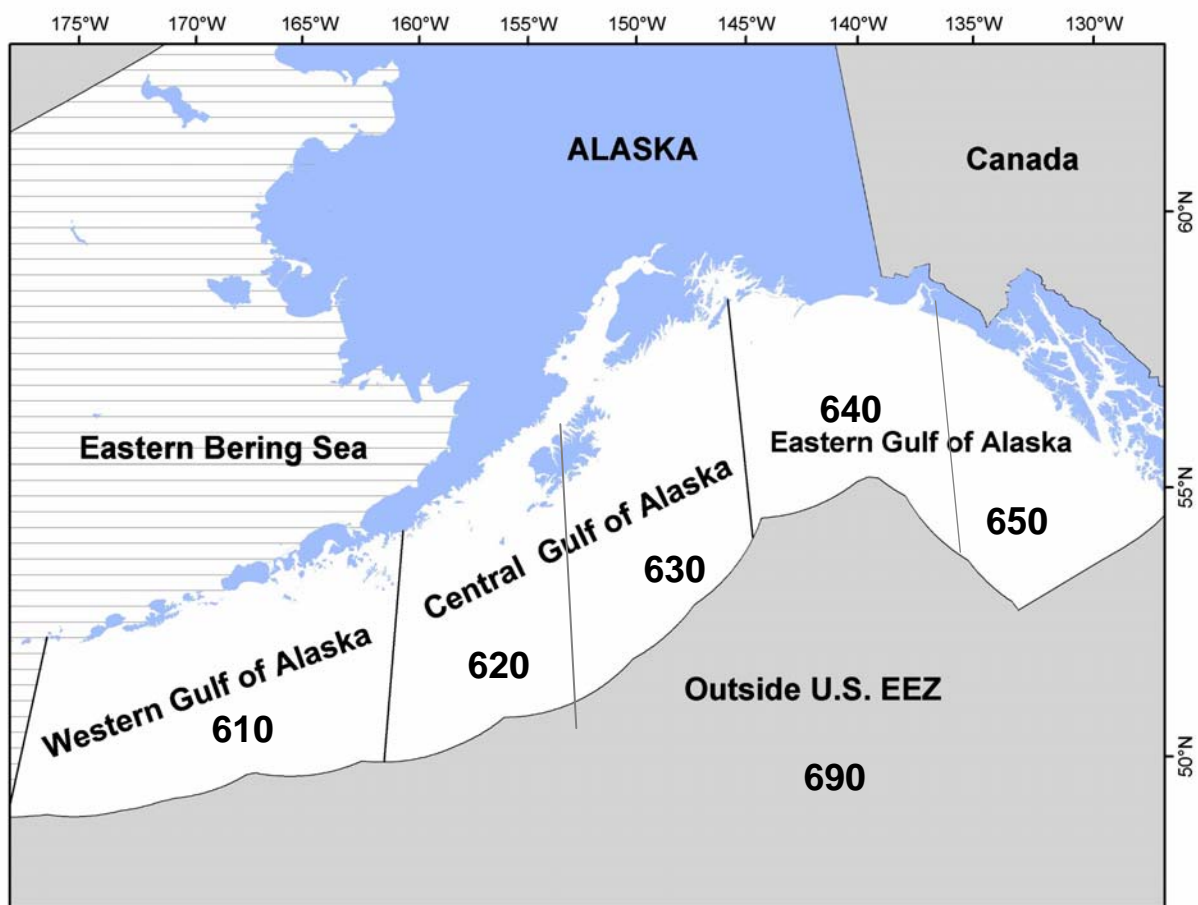


Figure 1. Gulf of Alaska statistical and reporting areas.

